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**Chapter 43D Violation / 244 Worcester St, North Grafton, MA 01536 / Case 2021-876**

1 message

**'Robert Holmes' via Planning Department** <PlanningDept@grafton-ma.gov>

Mon, Sep 20, 2021 at 4:54 AM

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Attachment available until Oct 20, 2021

Good morning,

I am writing this morning looking for the State of Massachusetts to intervene in the proposed building of a 24 hour warehouse facility in a residential neighborhood. The site is located at the Wyman Gordan Plant, [244 Worcester St, North Grafton, MA 01536](#).

This is a chapter 43D project and based on community protections listed in section 43D, I believe that this development is in violation of law as written for the Commonwealth. I have attached the traffic study, which as per the community protections listed in chapter 43D, **contains false or misleading information**. The traffic study was prepared during COVID which does not represent true traffic numbers for Rt 122. The project is trying to use false and/or misleading information too fast track a warehouse project that will affect the community.

In addition, there has been **NO environmental impact report done** or submitted to the town for community review. I feel that intervention from the Commonwealth is the only way citizens in North Grafton will be protected. Thank you for your time and attention to this matter.

Sincerely,

Robert F Holmes

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North Grafton, MA 01536

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traffic\_report\_04138982xa166b.pdf

41.8 MB

# **Transportation Impact Assessment**

Proposed Warehouse  
244 Worcester Street  
North Grafton, Massachusetts

*Prepared for:*

Churchill & Banks, LLC  
Providence, Rhode Island

May 2021

*Prepared by:*

 **Vanasse &  
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## **EXECUTIVE SUMMARY**

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Vanasse & Associates, Inc. (VAI) has prepared this Transportation Impact Assessment (TIA) in order to evaluate potential traffic impacts associated with the proposed warehouse development to be located at 244 Worcester Street in Grafton, Massachusetts (the "Project"). This study evaluates the following specific areas as they relate to the Project: i) access requirements; ii) potential off-site improvements; and iii) safety considerations; and identifies and analyzes existing and future traffic conditions, both with and without the Project.

### **PROJECT DESCRIPTION**

The proposed development entails construction of a 375,000 square foot (sf) warehouse building with approximately 240 employee parking spaces, 84-trailer storage, and 92 loading docks. The Project site is located in the front lot of an existing industrial building occupied by the Wyman-Gordon company. Currently, access to the project site is provided by three driveways onto Worcester Street (Route 122). As part of the site development, the existing Wyman-Gordon driveway (Site Drive B) opposite Brigham Hill Road will be closed. Access to the new warehouse and to the Wyman-Gordon property will be provided via two existing shared driveways onto Route 122 (Site Drive A and C). The western driveway (Site Drive C) will be exclusively used by Wyman-Gordon employees/visitors. The eastern driveway (Site Drive A) will be intended for Wyman-Gordon trucks and new warehouse trucks and employees.

### **EXISTING CONDITIONS**

A comprehensive field inventory of traffic conditions on the study area roadways was conducted in March 2021.

#### **Existing Traffic Volumes**

In order to establish base traffic-volume conditions within the study area, manual turning movement counts (TMCs) and automatic traffic recorder count (ATR) were completed in March 2021. The TMCs were conducted during the weekday morning and weekday evening peak periods, which represent the peak periods for the Project traffic. The ATR was conducted at Route 122 for 48 hours (Tuesday through Wednesday). In order to develop 2021 Existing traffic-volume conditions, the data collected required adjustments due to the effects of the COVID-19 pandemic. Based on

the evaluation of the existing permanent count station, the 2021 weekday morning and evening peak-hour traffic volumes were increased by 16 percent.

### **Safety Analysis**

Motor vehicle crash data was acquired from the Massachusetts Department of Transportation (MassDOT) Safety Management/Traffic Operations Unit for the most recent five-year period available (2014 through 2018) in order to examine motor vehicle crash trends occurring within the study area. The intersection of Massachusetts Turnpike (I-90) westbound ramp (Exit 11) at Grafton Road (Route 122) interchange experienced the highest frequency of accidents over the five-year review period with a total of 8 accidents reported. All of the study intersections were found to have a motor vehicle crash rate *below* the MassDOT average for the District in which the Project is located (District 3). No fatalities were reported at any of the study area intersections over the five-year period reviewed.

### **FUTURE CONDITIONS**

Traffic volumes within the study area were projected to 2028, which reflects a seven-year planning horizon consistent with State traffic study guidelines.

### **Background Traffic Growth**

Based on traffic-volume data compiled by MassDOT from permanent count stations, it was determined that traffic volumes within the study area have fluctuated over the past several years. In order to provide a prudent planning condition for the Project, a slightly higher 1.0 percent per year compounded annual background traffic growth rate was used in order to account for future traffic growth and presently unforeseen development within the study area.

### **Specific Development by Others**

The Towns of Grafton and Millbury were contacted in order to determine if there are any planned or approved specific development projects within the area that would have an impact on future traffic volumes at the study intersections. Based on these discussions, the proposed mixed-use development at 4 Abbott Road is the only future project identified in the immediate area of the Project site. Traffic from this site-specific project was estimated and incorporated into the study.

### **Planned Roadway Improvements**

The Towns of Grafton and Millbury were contacted to determine if there are any planned roadway improvements in the area that would have an impact on future traffic operations. Based on these discussions, no planned roadway improvement projects that would affect the study area were identified.

### **No-Build Traffic Volumes**

The 2028 No-Build weekday morning and evening peak-hour traffic-volume networks were developed by applying the 1 percent per year compounded annual background traffic growth rate to the 2021 existing condition peak-hour traffic volumes plus the identified background developments.

### **Site-Generated Traffic Volumes**

The proposed project entails construction of a 375,000-sf warehouse building. In order to develop the traffic characteristics of this project, trip-generation statistics published by the Institute of Transportation Engineers (ITE)<sup>1</sup> for Land Use Code (LUC) 150, *Warehouse* was used. Trip-generation calculations were performed for a typical weekday, as well as the weekday morning and weekday evening peak hours, the critical time periods for Project-related traffic activity. The proposed development is expected to generate approximately 638 new vehicle trips on an average weekday (two-way, 24-hour volume), with 64 new vehicle trips (49 entering and 15 exiting) expected during the weekday morning peak hour and 71 new vehicle trips (19 entering and 52 exiting) expected during the weekday evening peak hour.

It should be noted that a conventional warehouse use is proposed for the site. The site is not anticipated to contain any of the specialized warehouse types such as a “Last Mile” warehouse or fulfillment center, related to localized distribution of e-commerce items. Accordingly, trips were based on the general warehouse land use code of warehousing for this analysis.

### **Trip Distribution and Assignment**

The directional distribution of generated trips to and from the Project site was determined based on a review of existing traffic patterns within the study area. In summary, 30 percent of the trips are expected to arrive and depart the site to/from the east and 70 percent of the trips are expected to arrive and depart the site to/from the west.

## **TRAFFIC OPERATIONS ANALYSIS**

In order to assess the impact of the proposed Project on the roadway network, traffic operations analyses were performed at the study intersections under 2021 Existing, 2028 No-Build, and 2028 Build conditions. The addition of site-related traffic will not result in a significant impact on overall operations at the study area intersections.

## **RECOMMENDATIONS**

The following recommendations have been developed as a part of this evaluation and, where applicable, will be completed in conjunction with the Project subject to receipt of all necessary rights, permits, and approvals.

### **Project Access**

Access and egress to the Project site will be provided by two full-access driveways onto Worcester Street (Route 122). The following recommendations are offered with respect to Project access, internal circulation, and parking, many of which are already reflected on the Site Plans for the Project:

- Vehicles exiting the Project site should be placed under STOP-sign control with a marked STOP-line provided.

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<sup>1</sup>*Trip Generation*, 10<sup>th</sup> Edition; Institute of Transportation Engineers; Washington, DC; 2017.

- All signs and pavement markings to be installed within the Project site should conform to the applicable standards of the *Manual on Uniform Traffic Control Devices (MUTCD)*.<sup>2</sup>
- Signs and landscaping to be installed as a part of the Project within intersection sight triangle areas of the Project site driveways should be designed and maintained so as not to restrict lines of sight.
- Snow windows within the sight triangle areas of the Project site driveways and at intersections within the Project site should be promptly removed where such accumulations would impede sight lines.

### **Off-Site Improvement**

#### **Route 122 Traffic Calming**

**Speed Radar Signs.** The traffic data documented herein indicates that vehicles are traveling above the legally enforceable posted speed limit. One potential mitigation measure includes the installation of Dynamic Speed Feedback Signs along Route 122. Dynamic Speed Feedback Signs are radar activated signs that dynamically display approaching speeds for individual vehicles or display messages such as “SLOW DOWN” or “REDUCE SPEED” when a vehicle exceeds a certain speed. They alert drivers that they are speeding and create a sense of being monitored.

### **CONCLUSIONS**

The proposed Project will not result in a significant impact on overall operations. With the implementation of the above recommendations, safe and efficient access will be provided to the planned development and the proposed development can be constructed with minimal impact to the area.

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<sup>2</sup>*Manual on Uniform Traffic Control Devices (MUTCD)*; Federal Highway Administration; Washington, D.C.; 2009.

## **INTRODUCTION**

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Vanasse & Associates, Inc. (VAI) has prepared this Transportation Impact Assessment (TIA) in order to evaluate potential traffic impacts associated with the proposed warehouse development to be located at 244 Worcester Street in Grafton, Massachusetts (the "Project"). This study evaluates the following specific areas as they relate to the Project: i) access requirements; ii) potential off-site improvements; and iii) safety considerations; and identifies and analyzes existing and future traffic conditions, both with and without the Project.

### **PROJECT DESCRIPTION**

The proposed development entails construction of a 375,000 square foot (sf) warehouse building with approximately 240 employee parking spaces, 84-trailer storage, and 92 loading docks. The Project site is located in the front lot of an existing industrial building occupied by the Wyman-Gordon company. Currently, access to the project site is provided by three driveways onto Worcester Street (Route 122). As part of the site development, the existing Wyman-Gordon driveway (Site Drive B) opposite Brigham Hill Road will be closed. Access to the new warehouse and to the Wyman-Gordon property will be provided via two existing shared driveways onto Route 122 (Site Drive A and C). The western driveway (Site Drive C) will be exclusively used by Wyman-Gordon employees/visitors. The eastern driveway (Site Drive A) will be intended for Wyman-Gordon trucks and new warehouse trucks and employees.

### **STUDY METHODOLOGY**

This study was prepared in consultation with the Town of Grafton and in accordance with the Massachusetts Department of Transportation (MassDOT) Guidelines for *Transportation Impact Assessment (TIA) Guideline*; and the standards of the Traffic Engineering and Transportation Planning professions for the preparation of such reports; and was conducted in three distinct stages.

The first stage involved an assessment of existing conditions in the study area and included an inventory of roadway geometrics; pedestrian facilities; observations of traffic flow; review of safety characteristics along area roadways; and collection of daily and peak-period traffic counts.

In the second stage of the study, future traffic conditions were projected and analyzed. Specific travel demand forecasts for the Project were assessed along with future traffic demands due to

expected traffic growth independent of the Project. A seven-year time horizon was selected for analyses consistent with State guidelines for the preparation of TIAs. The traffic analysis conducted in stage two identifies existing or projected future roadway capacity, traffic safety, and site access issues.

The third stage of the study presents and evaluates measures to address traffic and safety issues, if any, identified in stage two of the study.

## **EXISTING CONDITIONS**

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A comprehensive field inventory of traffic conditions on the study area roadways was conducted in March 2021. The field investigation consisted of an inventory of existing roadway geometrics, pedestrian facilities, traffic volumes, and operating characteristics, as well as posted speed limits and land use information for the roadways that provide access to the Project including Worcester Street/Grafton Road (Route 122) as well as the intersections which are expected to accommodate the majority of Project-related traffic. The study area for the Project is listed below and graphically depicted in Figure 1.

1. Route 122 at Wyman-Gordon east drive (Site Drive A)
2. Route 122 at Wyman-Gordon main drive/Brigham Hill Road (Site Drive B)
3. Route 122 at Hilltop Street/ Wyman-Gordon west drive (Site Drive C)
4. Grafton Road (Route 122) at Massachusetts Turnpike (I-90) – westbound ramp (Exit 11)

The following describes the study area roadway and intersections:

### **GEOMETRY**

#### **Roadway**

##### **Worcester Street (Route 122)**

Worcester Street (Route 122) is a two-lane urban minor arterial under MassDOT jurisdiction that traverses the study area in a general west-east orientation providing access to I-90 and downtown Worcester to the west and Route 30 and Route 140 to the east. In the vicinity of the Project site, Worcester Street (Route 122) provides an approximate 12-foot wide travel lane in each direction, separated by a painted double-yellow centerline. An approximate 5- to 6-foot wide paved shoulder is provided along both sides of the corridor. Within the study area, sidewalk is partially provided along the south sides of the roadway, with painted crosswalks provided at most intersections. The posted speed limit along Route 122 is 35 miles per hour (mph). Land use along the corridor is a mix of residential, industrial, and commercial uses.

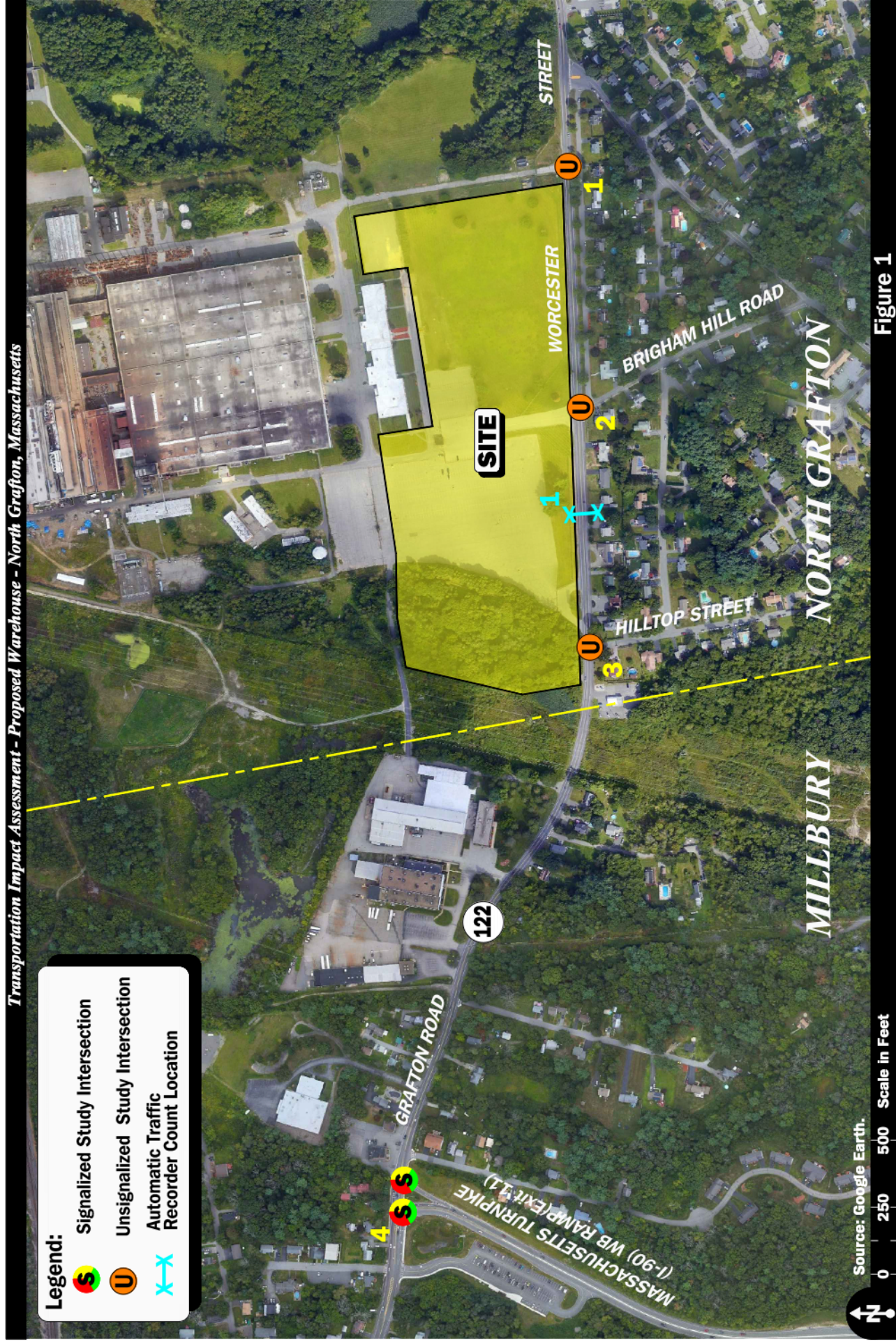


Figure 1

Site Location and Study Area Map

## **Intersections**

Figure 2 summarizes existing lane use and travel lane widths at the study area intersections as observed in March 2021.

## **EXISTING TRAFFIC VOLUMES**

In order to establish base traffic-volume conditions within the study area, manual turning movement counts (TMCs) were completed on Tuesday, March 23, 2021. The TMCs were conducted during the weekday morning (7:00 to 9:00 AM) and weekday evening (4:00 to 6:00 PM) peak periods, which represent the peak periods for commercial traffic. In addition, an automatic traffic recorder (ATR) count was conducted on March 23 and 24, 2021 at Route 122 for 48 hours (Tuesday through Wednesday).

### **Traffic Adjustment**

In order to develop 2021 Existing traffic-volume conditions, the data collected required adjustment due to the effects of the COVID-19 pandemic. To achieve this, count data from the MassDOT permanent count station ID 3991 located on Route 146 north of I-90 were reviewed.<sup>3</sup> Traffic-volume data collected at this continuous count station in March 2021 was compared to March 2018 traffic volumes that were collected at the same location. The 2018 traffic volumes were expanded to 2021 (same year condition) by applying a background traffic growth rate of 1.0 percent per year (discussion follows) in order to allow for a comparison of the data. Based on this pre- and post-COVID-19 traffic data comparison, the 2021 traffic-volume data that was collected as a part of this assessment were adjusted upward by an additional 16 percent, respectively, in order to account for the reduced traffic volumes resulting from the phased “Reopening Massachusetts” plan.

### **Seasonal Adjustment**

In addition to correction factors for COVID-19, adjustments were made to account for seasonal fluctuations in traffic. The MassDOT permanent count station ID 3991 were used to adjust the traffic volumes for seasonal fluctuations. Based on this data, it was determined that March traffic volumes are approximately 2.0 percent above than the average-month conditions for this station. Therefore, the March traffic volumes were not adjusted downward in order to provide a conservative analysis condition.

The 2021 Existing traffic volumes are summarized in Table 1, with the weekday morning and evening peak-hour traffic volumes graphically depicted on Figure 3. Note that the peak-hour traffic volumes presented in Table 1 were obtained from the TMCs and are reflected on the aforementioned figure.

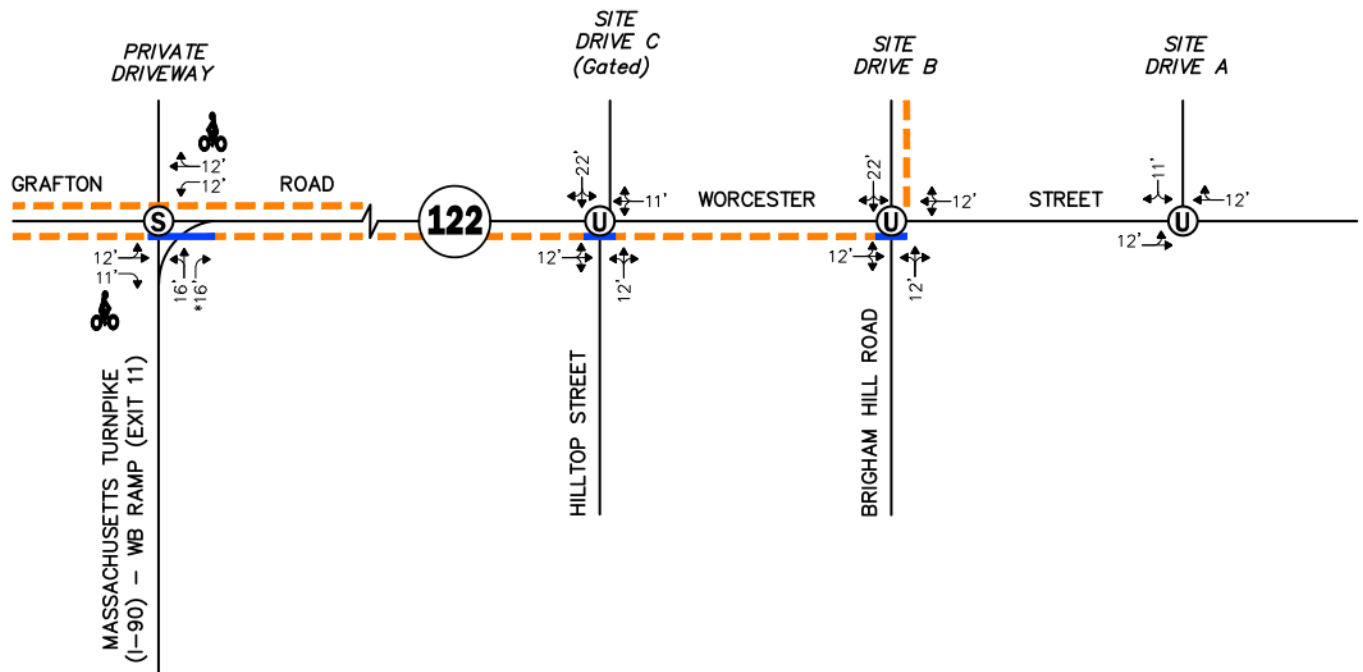
As can be seen in Table 1, Route 122, east of Hilltop Street was found to accommodate approximately 16,620 vehicles on an average weekday (24-hour, two-way volume), with approximately 1,162 vehicles per hour (vph) during the weekday morning peak hour and 1,523 vph during the weekday evening peak hour. The predominant flow on Route 122 during the weekday morning peak hour is in the westbound direction and during the weekday evening peak hour is in the east-bound direction.

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<sup>3</sup>MassDOT traffic volumes for the Commonwealth of Massachusetts; 2020.

**Legend:**

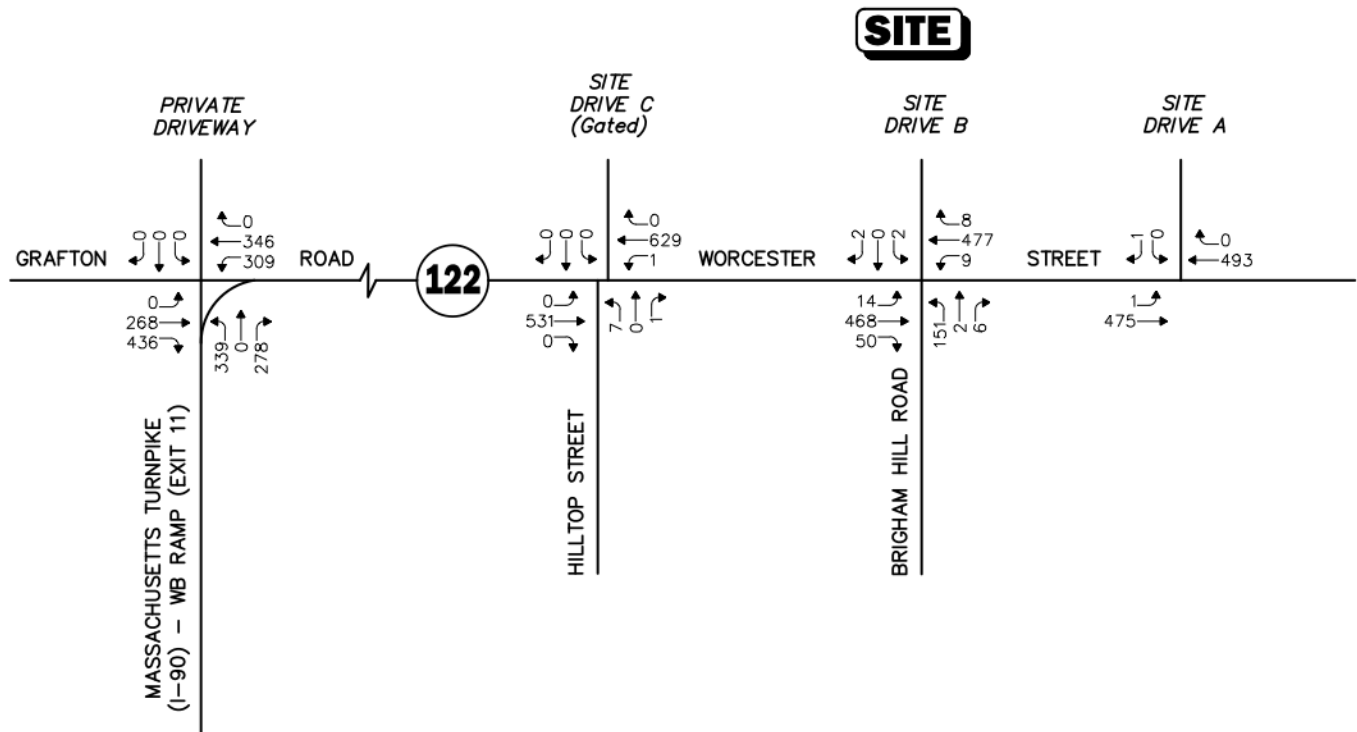
- Ⓢ Signalized Intersection
- Ⓤ Unsignalized Intersection
- Sidewalk
- Crosswalk
- XX' Lane Use and Travel Lane Width
- \*XX' Channelized Right Turn
- 🚲 Bike Lane



**Figure 2**

**Existing Intersection Lane Use, Travel Lane Width and Pedestrian Facilities**

WEEKDAY MORNING PEAK HOUR (7:15 - 8:15 AM)



WEEKDAY EVENING PEAK HOUR (4:00 - 5:00 PM)

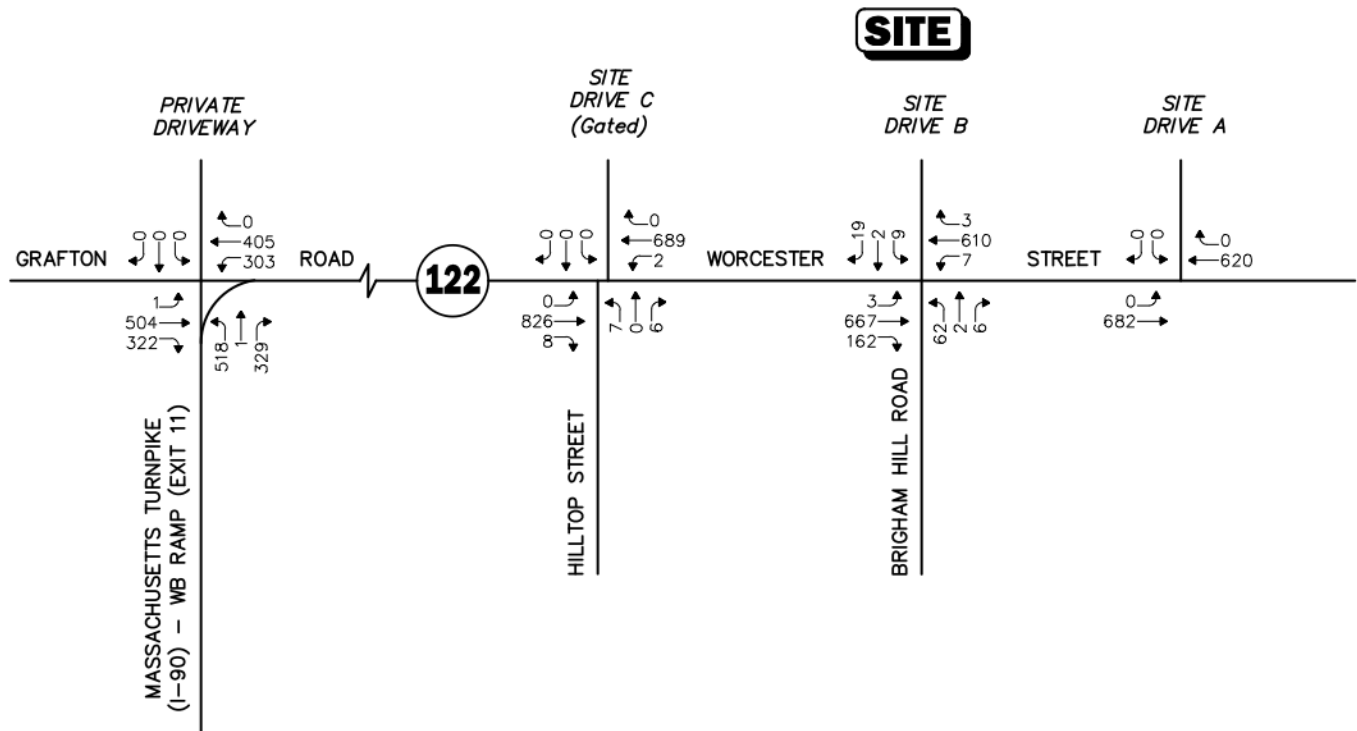


Figure 3

2021 Existing Conditions  
Weekday  
Peak Hour Traffic Volumes

A review of the peak-period traffic counts indicates that the weekday morning peak hour generally occurs between 7:15 and 8:15 AM with the weekday evening peak hour generally occurring between 4:00 and 5:00 PM.

**Table 1**  
**EXISTING ROADWAY TRAFFIC-VOLUME SUMMARY**

Location	Daily Volume (vpd) <sup>a</sup>	Weekday Morning Peak Hour (7:15 – 8:15 AM)			Weekday Afternoon Peak Hour (4:00 – 5:00PM)		
		Volume (vph) <sup>b</sup>	Percent of Daily Traffic	Predominant Flow	Volume (vph)	Percent of Daily Traffic	Predominant Flow
Worcester Street (Route 122), east of Hilltop Street	16,620	1,162	7.0	54% WB	1,523	9.1	54% EB

<sup>a</sup>Two-way daily traffic expressed in vehicles per day; from ATR counts, March 2021 (adjusted).

<sup>b</sup>Manual turning movement counts conducted in March 2021 (adjusted).

<sup>c</sup>The percent of daily traffic that occurs during the peak hour.

WB= westbound; EB= eastbound.

## **PEDESTRIAN AND BICYCLE FACILITIES**

A comprehensive field inventory of pedestrian and bicycle facilities within the study area was undertaken in March 2021. The field inventory consisted of a review of the location of sidewalks and pedestrian crossing locations along the study roadway and at the study intersections, as well as the location of existing and planned future bicycle facilities. As detailed on Figure 2, sidewalk is partially provided along the south sides of Route 122, with painted crosswalks provided at most intersections. Formal bicycle lanes were noted at the intersection of Massachusetts Turnpike (I-90) westbound ramp (Exit 11) at Route 122. Formal bicycle facilities are not provided on Route 122 along site frontage; however, Route 122 provides sufficient width (combined travel lane and paved shoulder) to support bicycle travel in a shared traveled-way configuration.<sup>4</sup>

## **PUBLIC TRANSPORTATION**

Public transportation services are provided within the study area by the Massachusetts Bay Transportation Authority (MBTA) for commuter rail service. The Framingham/Worcester Purple Line Grafton station is the closest station to the proposed development. The station is located approximately 3.5 miles north/east of the site, approximately 8 minutes driving. The MBTA commuter rail line provides convenient access to Boston and operates Monday through Friday from 4:15 AM to 12:25 PM. Commuter rail zone (actual zone is Zones 1A-10) fares are \$2.40 to \$13.25 one way and \$90.00 for a monthly pass.

All MBTA trains are handicapped and wheelchair accessible. Schedule and fare information for the MBTA fixed-route bus and commuter rail service are provided in the Appendix.

<sup>4</sup>A minimum combined travel lane and paved shoulder width of 14-feet is required to support bicycle travel in a shared traveled-way condition.

## **SAFETY ANALYSIS**

In order to evaluate whether there are any notable trends that would indicate potential safety deficiencies within the study area, a motor vehicle accident analysis was conducted in accordance with State guidelines as described below.

### **Vehicle Accident Data**

Motor vehicle accident data was acquired from the MassDOT Safety Management/Traffic Operations Unit for the most recent five-year period available (2014 through 2018) in order to examine motor vehicle accident trends occurring within the study area. The data is summarized by intersection, type, and severity, and is presented in Table 2.

As summarized in Table 2, the intersection of Massachusetts Turnpike (I-90) westbound ramp (Exit 11) at Route 122 interchange experienced the highest frequency of accidents in the study area with a total of 8 accidents over the five-year review period, averaging 1.6 accidents per year. The majority of the accidents were rear-end collisions (5 out of 8), occurred on dry pavement (6 out of 8), during the daylight (7 out of 8), in clear weather (4 out of 8), and caused property damage only (6 out of 8). All study intersections were found to have a motor vehicle crash rate *below* the MassDOT average for the District in which the Project is located (District 3). No fatalities were reported at any of the study area intersections over the five-year period reviewed. In addition, the Highway Safety Improvement Program (HSIP) database was reviewed and none of the study area intersections are listed as HSIP-eligible clusters in the most recent (2015 through 2017) HSIP cluster listing. The detailed MassDOT Crash Rate Worksheets are provided in the Appendix.

**Table 2**  
**MOTOR VEHICLE ACCIDENT DATA SUMMARY<sup>a</sup>**

Scenario	Route 122 at Site Drive A (Unsignalized)	Route 122 at Site Drive B/ Brigham Hill Road (Unsignalized)	Route 122 at Hilltop Street/ Site Drive C (Unsignalized)	Route 122 at I-90 WB Ramp Exit 11 (Signalized)
<i>Year:</i>				
2014	0	1	1	2
2015	0	0	0	1
2016	0	0	0	3
2017	0	0	0	1
2018	0	1	0	1
Total	0	2	1	8
Average <sup>a</sup>	0.00	0.40	0.20	1.60
Crash Rate <sup>b</sup>	--	0.06	0.03	0.17
Significant <sup>c</sup>	--	No	No	No
<i>Type:</i>				
Angle	0	2	0	0
Rear-End	0	0	1	6
Head-On	0	0	0	1
Sideswipe	0	0	0	1
Fixed Object	0	0	0	0
Pedestrian	0	0	0	0
Bicyclist	0	0	0	0
Unknown/Other	0	0	0	0
Total	0	2	1	8
<i>Weather Conditions:</i>				
Clear	0	1	1	4
Cloudy/Rain	0	0	0	4
Snow/Ice	0	1	0	0
Fog	0	0	0	0
Unknown/Other	0	0	0	0
Total	0	2	1	8
<i>Lighting Conditions:</i>				
Daylight	0	2	1	7
Dawn/Dusk	0	0	0	0
Dark (lit)	0	0	0	1
Dark (unlit)	0	0	0	0
Unknown/Other	0	0	0	0
Total	0	2	1	8
<i>Pavement Conditions :</i>				
Dry	0	1	1	6
Wet	0	0	0	2
Snow/Ice	0	1	0	0
Unknown/Other	0	0	0	0
Total	0	2	1	8
<i>Severity:</i>				
Property Damage Only	0	2	1	6
Personal Injury	0	0	0	2
Fatality	0	0	0	0
Unknown/Other	0	0	0	0
Total	0	2	1	8

<sup>a</sup>Source: MassDOT, 2014 through 2018.

<sup>b</sup>Average crashes over five-year period.

<sup>c</sup>Crash rate per million entering vehicles.

Unsignalized intersections are significant if rate >0.61 crashes per million vehicles (District 3) or if rate >0.57 crashes per million vehicles (Statewide).

Signalized intersections are significant if rate >0.89 crashes per million vehicles (District 3) or if rate >0.78 crashes per million vehicles (Statewide).

### **SPOT SPEED MEASUREMENTS**

Vehicle travel speed measurements were performed along Route 122 in the vicinity of the Project site. Table 3 summarizes the vehicle travel speed measurements.

**Table 3**  
**VEHICLE TRAVEL SPEED MEASUREMENTS**

	Route 122 Westbound	Route 122 Eastbound
Mean Travel Speed (mph)	38	36
85 <sup>th</sup> Percentile Speed (mph)	43	40
Posted Speed Limit (mph)	35	35

mph = miles per hour.

As can be seen in Table 3, the mean (average) vehicle travel speed along Route 122, in the vicinity of the Project site, was found to be approximately 38 mph in the westbound and approximately 36 mph in the eastbound direction. The measured 85<sup>th</sup> percentile vehicle travel speed, or the speed at which 85 percent of the observed vehicles traveled above, was found to be approximately 43mph in the westbound and approximately 40 mph eastbound direction.

The 85<sup>th</sup> percentile speed of vehicle traveling in the westbound and eastbound direction was found to be 8 mph and 5 mph, respectively, above the posted speed limit (35 mph) along Route 122 and in. Overall, the speed study indicates non-compliant speed of travel for vehicles traveling in each direction considering the 35 mph posted speed limits.

## **FUTURE CONDITIONS**

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Traffic volumes in the study area were projected to the year 2028, which reflects a seven-year planning horizon consistent with State Traffic Study Guidelines. Independent of the Project, traffic volumes on the roadway network in the year 2028 under No-Build conditions include all existing traffic and new traffic resulting from background traffic growth. Anticipated Project-generated traffic volumes superimposed upon this 2028 No-Build traffic network reflect the 2028 Build conditions with the Project.

### **FUTURE TRAFFIC GROWTH**

Future traffic growth is a function of the expected land development in the immediate area and the surrounding region. Several methods can be used to estimate this growth. A procedure frequently employed estimates an annual percentage increase in traffic growth and applies that percentage to all traffic volumes under study. The drawback to such a procedure is that some turning volumes may actually grow at either a higher or a lower rate at particular intersections.

An alternative procedure identifies the location and type of planned development, estimates the traffic to be generated, and assigns it to the area roadway network. This procedure produces a more realistic estimate of growth for local traffic. However, the drawback of this procedure is that the potential growth in population and development external to the study area would not be accounted for in the traffic projections.

To provide a conservative analysis framework, both procedures were used, the salient components of which are described below.

### **GENERAL BACKGROUND TRAFFIC GROWTH**

Traffic-volume data compiled by MassDOT from permanent count stations and historic traffic counts in the area were reviewed in order to determine general background traffic growth trends. Based on this data, it was determined that traffic volumes within the study area have fluctuated over the past several years. In order to provide a prudent planning condition for the Project, a slightly higher 1.0 percent per year compounded annual background traffic growth rate was used in order to account for future traffic growth and presently unforeseen development within the study area.

## **SPECIFIC DEVELOPMENT BY OTHERS**

The Towns of Grafton and Millbury were contacted in order to determine if there are any planned or approved development projects that are expected to influence future traffic volumes within the study area. Based on these discussions, the following project was identified for inclusion in this assessment:

- **4 Abbott Road – Proposed Mixed Use Development** – The project will entail construction of a mix-use development including a 1,700 sf office building and two multifamily units with approximately 13 parking spaces. This project is currently in the permitting stage. Traffic volumes associated with this development were obtained using trip-generation information available from the Institute of Transportation Engineers (ITE)<sup>5</sup> for the appropriate land use and were assigned onto the study area roadway network based on existing traffic patterns. These volumes were included in the future condition networks.

No other developments were identified at this time that are expected to result in an increase in traffic within the study area beyond the general background traffic growth rate.

## **ROADWAY IMPROVEMENT PROJECTS**

The Towns of Grafton and Millbury were contacted to determine if there are any planned roadway improvements in the area that would have an impact on future traffic operations. Based on these discussions, no planned roadway improvement projects that would affect the study area were identified.

## **NO-BUILD TRAFFIC VOLUMES**

The 2028 No-Build peak-hour traffic-volume networks were developed by applying the 1 percent per year compounded annual background traffic growth rate to the 2021 Existing peak-hour traffic volumes plus the identified background developments. The resulting 2028 No-Build weekday morning and weekday evening peak-hour traffic-volume networks are shown on Figure 4.

## **PROJECT-GENERATED TRAFFIC**

The proposal entails construction of 375,000 sf warehouse building. In order to develop the traffic characteristics of this proposal, trip-generation statistics published by the Institute of Transportation Engineers (ITE) for Land Use Code (LUC) 150, *Warehousing* was used to develop the traffic characteristics of the proposal.

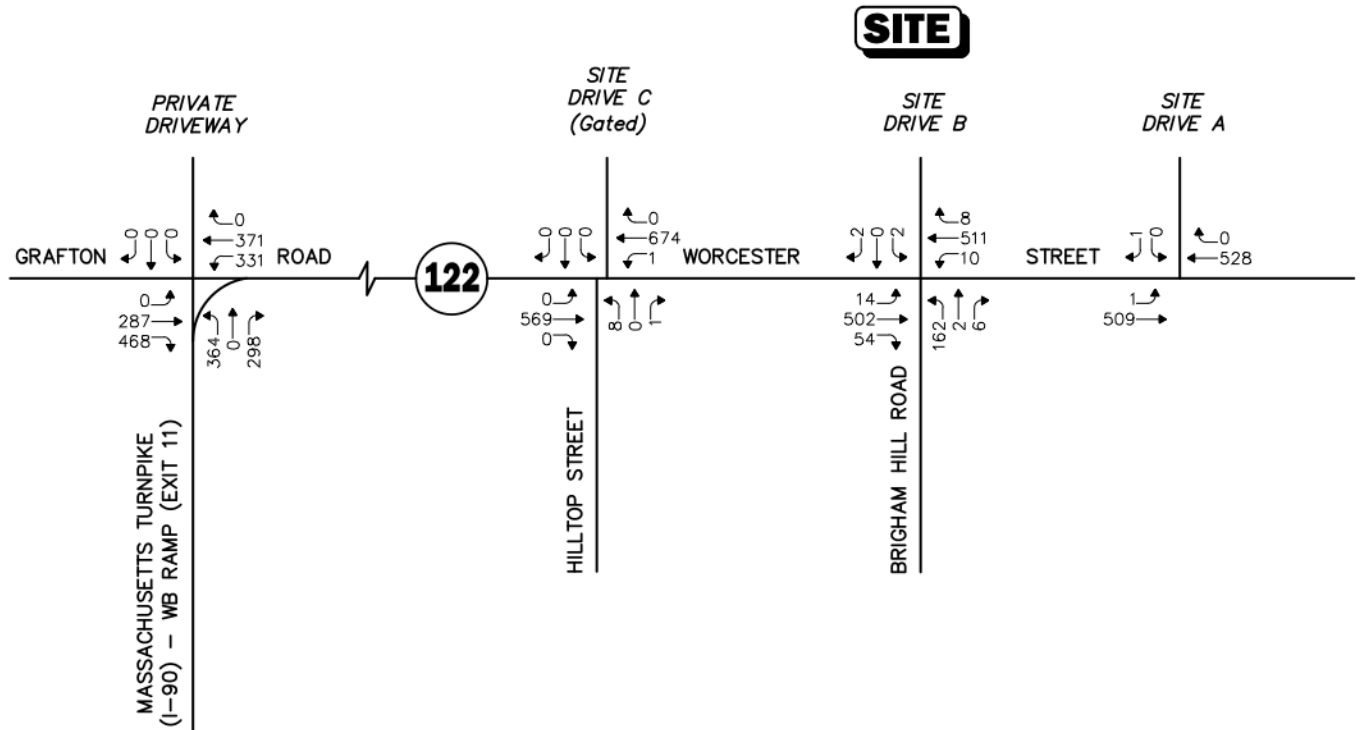
It should be noted that a conventional warehouse use is proposed for the site. The site is not anticipated to contain any of the specialized warehouse types such as a “Last Mile” warehouse or fulfillment center, related to localized distribution of e-commerce items. Accordingly, trips were based on the general warehouse land use code of warehousing for this analysis.

Trip-generation calculations were performed for a typical weekday, as well as the weekday morning and weekday evening peak hours, the critical time periods for Project-related traffic activity.

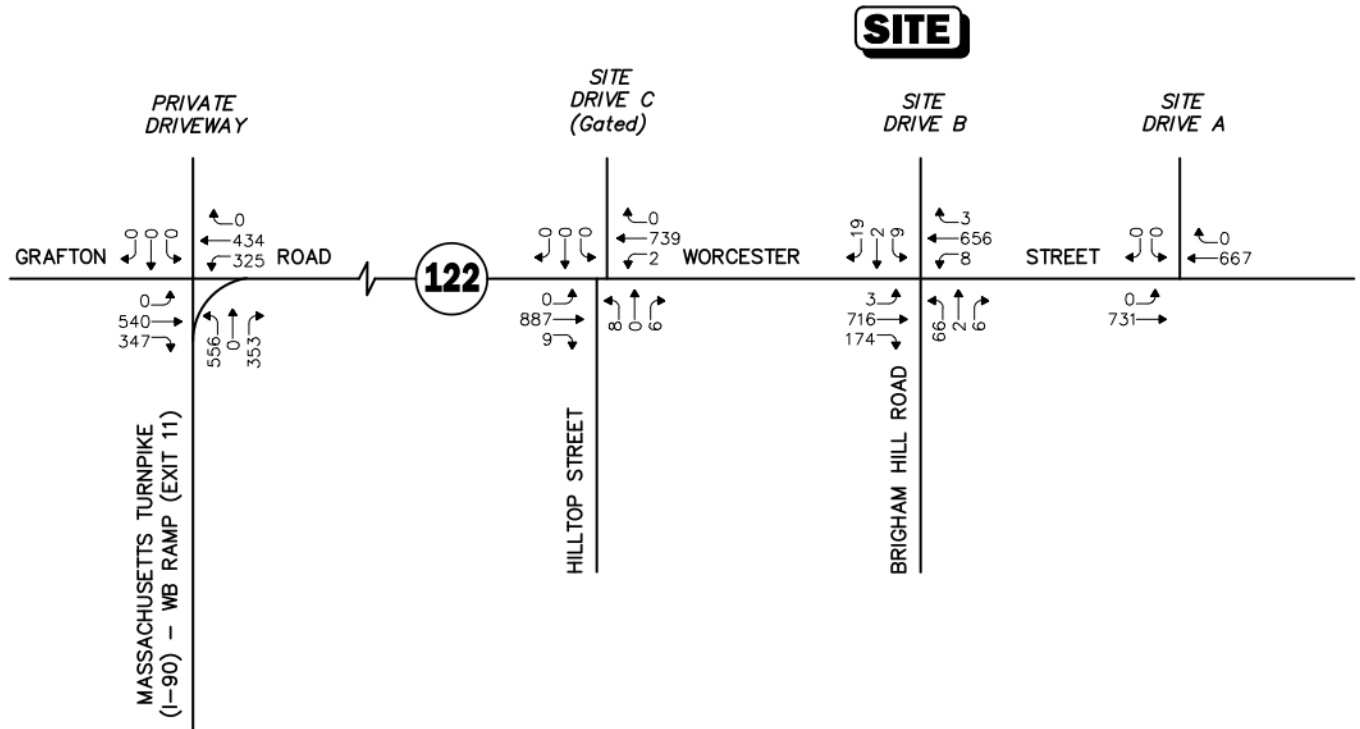
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<sup>5</sup>Ibid 1.

WEEKDAY MORNING PEAK HOUR (7:15 - 8:15 AM)



WEEKDAY EVENING PEAK HOUR (4:00 - 5:00 PM)



A summary of the expected vehicle-trip generation is summarized in Table 4.

**Table 4**  
**TRIP-GENERATION SUMMARY**

Time Period/Direction	Proposed Warehouse Car Trips (375,000 sf)	Proposed Warehouse Truck Trips (375,000 sf) <sup>a</sup>	Proposed Warehouse Total Trips (375,000 sf) <sup>b</sup>
Weekday Daily	412	226	638
<i>Weekday Morning Peak Hour:</i>			
Entering	45	4	49
Exiting	<u>11</u>	<u>4</u>	<u>15</u>
Total	56	8	64
<i>Weekday Evening Peak Hour:</i>			
Entering	13	6	19
Exiting	<u>47</u>	<u>5</u>	<u>52</u>
Total	60	11	71

<sup>a</sup>Based on ITE LUC 150, *Warehouse* – truck trips.

<sup>b</sup>Based on ITE LUC 150, *Warehouse* – car and truck trips.

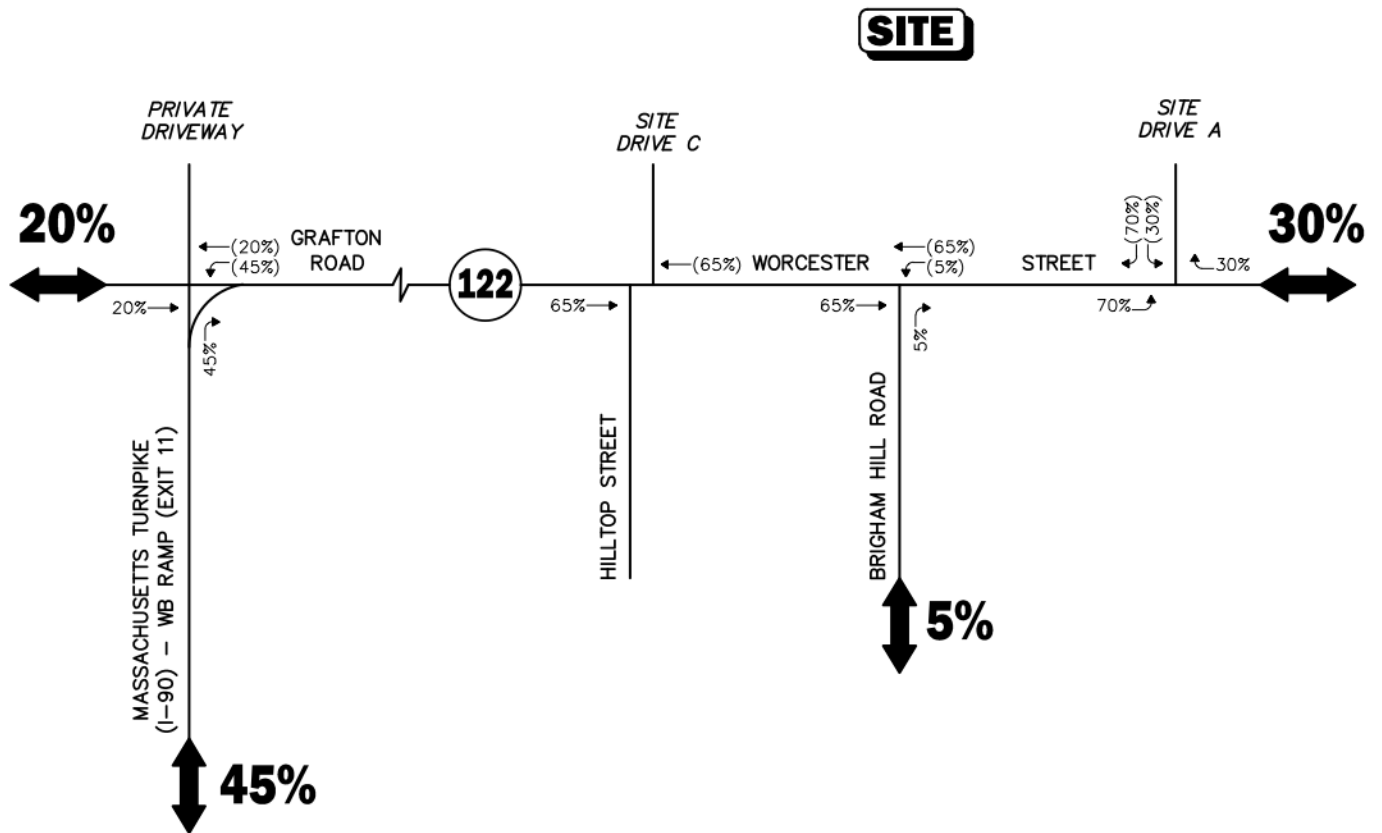
As shown in Table 4, the proposed 375,000 sf warehouse building is expected to generate approximately 638 new vehicle trips on an average weekday (two-way, 24-hour volume), with 64 new vehicle trips (49 entering and 15 exiting) expected during the weekday morning peak hour and 71 new vehicle trips (19 entering and 52 exiting) expected during the weekday evening peak hour.

### **TRIP DISTRIBUTION AND ASSIGNMENT**

The directional distribution of the site-generated trips was determined based on a review of existing travel patterns. The general trip distribution for the proposal is summarized in Table 5 and graphically depicted on Figure 5. The weekday morning and weekday evening peak-hour traffic volumes expected to be generated by the warehouse development were assigned on the study area roadway network as shown on Figure 6.

**Legend:**

XX Entering Trips  
(XX) Exiting Trips

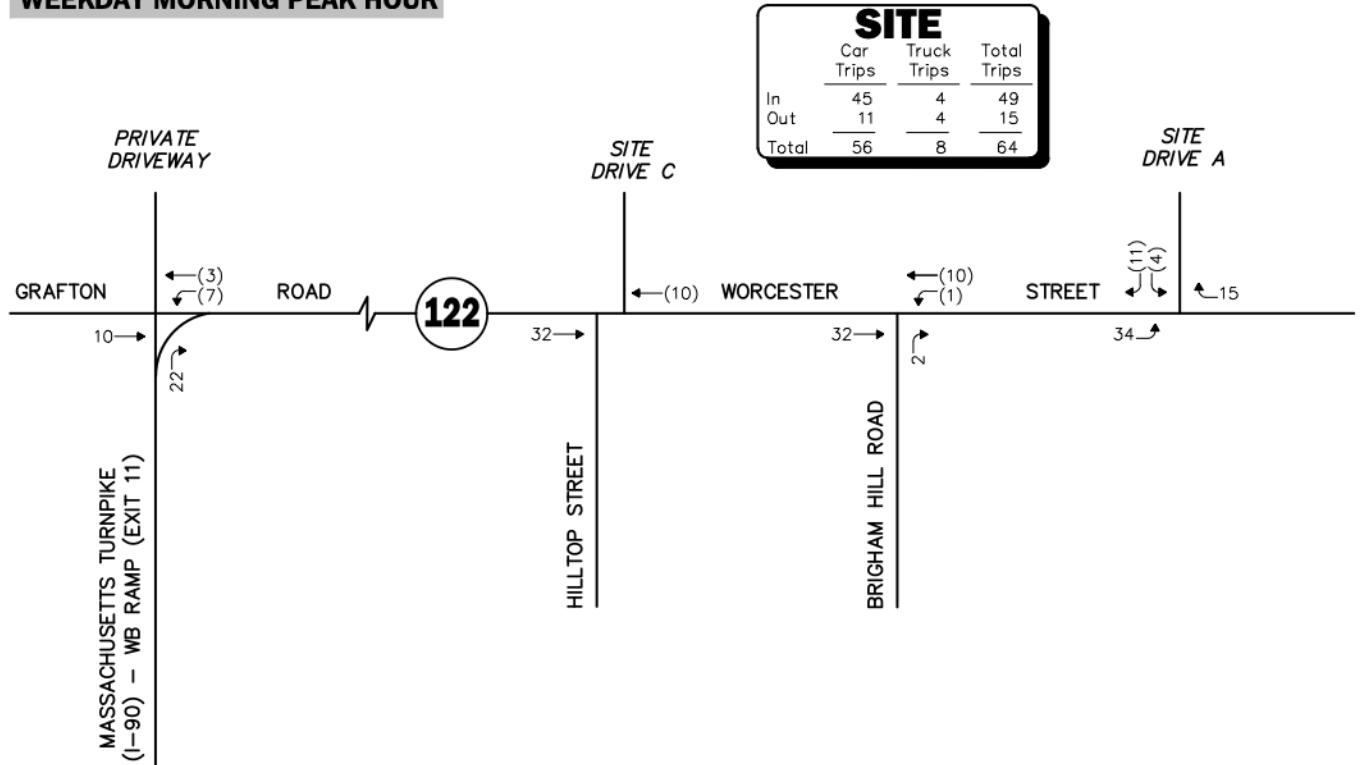


**Figure 5**

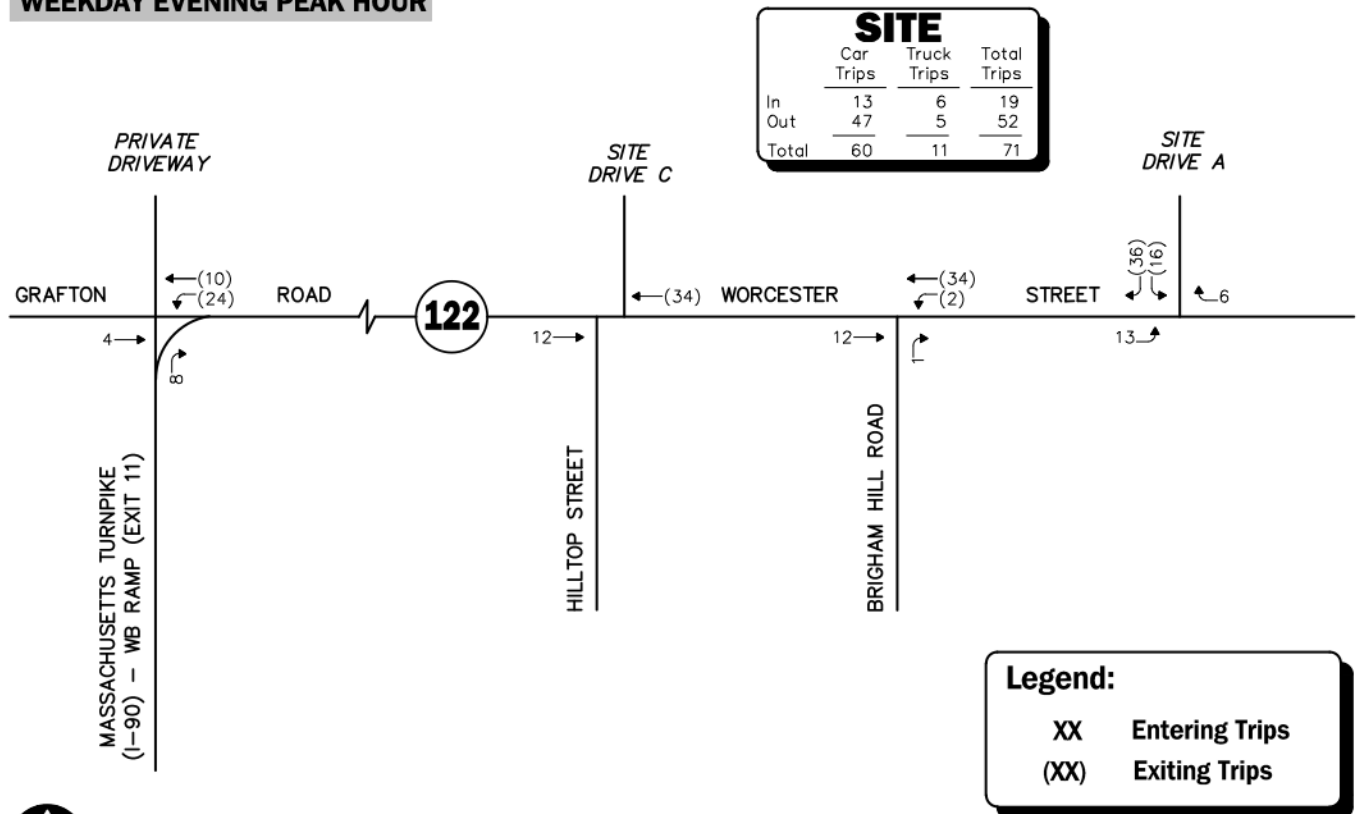
**Trip Distribution Map**



WEEKDAY MORNING PEAK HOUR



WEEKDAY EVENING PEAK HOUR



Not To Scale Figure 6

**Table 5**  
**TRIP-DISTRIBUTION SUMMARY**

Roadway	Direction (To/From)	Percentage (To/From)
Worcester Street (Route 53)	East	30
Grafton Road (Route 53)	West	20
I-90	South	45
<u>Brigham Hill Road</u>	South	<u>5</u>
<b>TOTAL</b>		<b>100</b>

### **FUTURE TRAFFIC VOLUMES - BUILD CONDITION**

The 2028 Build condition networks consist of the 2028 No-Build traffic volumes with the proposed site-generated traffic added to them. The 2028 Build weekday morning and weekday evening peak-hour traffic-volume networks are graphically depicted on Figure 7. A summary of peak-hour projected traffic-volume increases external to the study area that is the subject of this assessment is shown in Table 6. These volumes are based on the expected increases from the Project.

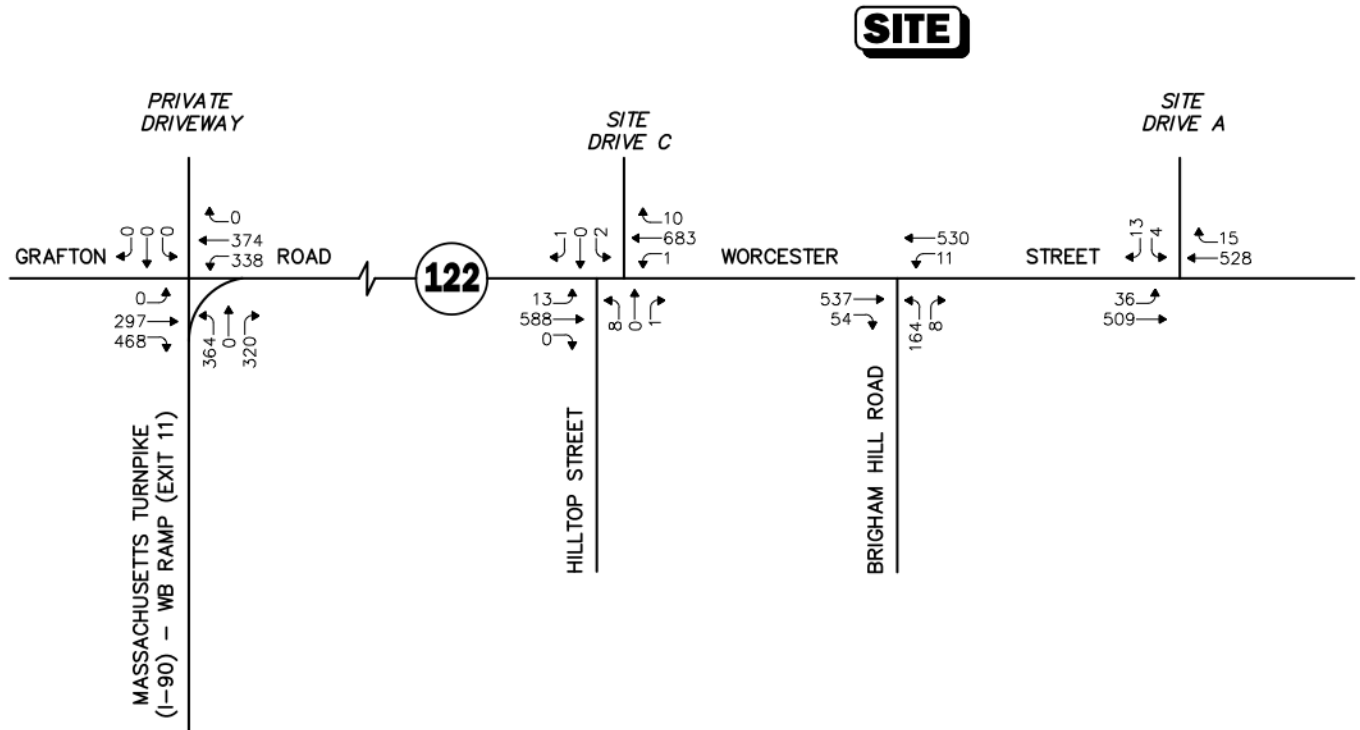
**Table 6**  
**PEAK-HOUR TRAFFIC-VOLUME INCREASES<sup>a</sup>**

Location/Peak Hour	2028 No-Build	2028 Build	Traffic-Volume Increase Over No-Build	Percent Increase Over No-Build
<i>Route 122, east of Site Drive A:</i>				
Weekday Morning	1,056	1,056	19	1.8
Weekday Evening	1,398	1,420	22	1.6
<i>Brigham Hill Road, south of Route 122:</i>				
Weekday Morning	234	237	3	1.3
Weekday Evening	258	261	3	1.2
<i>I-90, south of Route 122:</i>				
Weekday Morning	1,461	1,490	29	2.0
Weekday Evening	1,581	1,613	32	2.0
<i>Route 122, west of I-90:</i>				
Weekday Morning	1,490	1,503	13	0.9
Weekday Evening	1,877	1,891	14	0.7

<sup>a</sup>Vehicles per hour, total of both directions.

As shown in Table 6, in comparison to future No-Build conditions, Project-related traffic increases are projected to range between 3 to 32 vehicles during peak hours, with traffic percent increases ranging 0.7 to 2.0 percent.

WEEKDAY MORNING PEAK HOUR



WEEKDAY EVENING PEAK HOUR

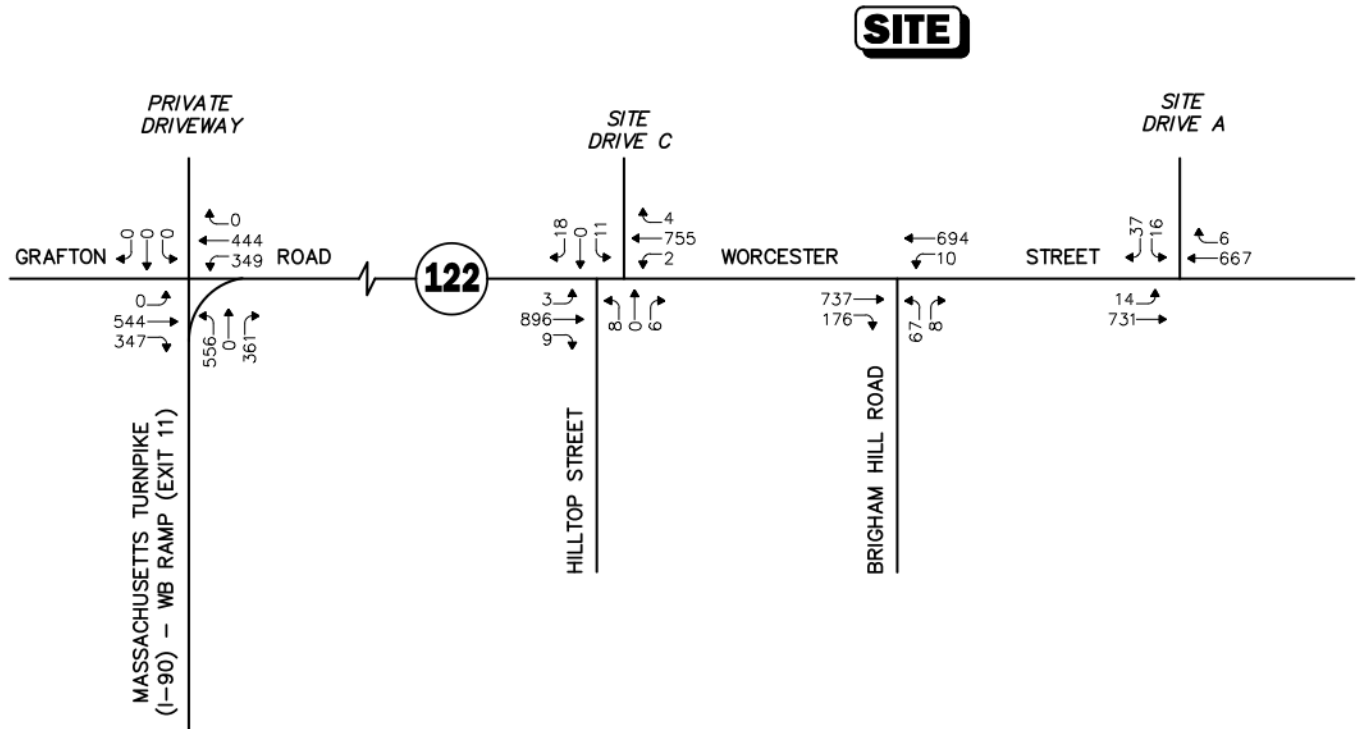


Figure 7

2028 Build Condition  
Weekday  
Peak Hour Traffic Volumes

## SIGHT DISTANCE EVALUATION

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Sight distance measurements were performed at both site driveways intersection with Route 122 in accordance with MassDOT and American Association of State Highway and Transportation Officials (AASHTO)<sup>6</sup> requirements. Both stopping sight distance (SSD) and intersection sight distance (ISD) measurements were performed. In brief, SSD is the distance required by a vehicle traveling at the design speed of a roadway, on wet pavement, to stop prior to striking an object in its travel path. ISD or corner sight distance (CSD) is the sight distance required by a driver entering or crossing an intersecting roadway to perceive an on-coming vehicle and safely complete a turning or crossing maneuver with on-coming traffic. In accordance with AASHTO standards, if the measured ISD is at least equal to the required SSD value for the appropriate design speed, the intersection can operate in a safe manner. Table 7 presents the measured SSD and ISD at the subject intersections.

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<sup>6</sup>*A Policy on Geometric Design of Highway and Streets*, 7<sup>th</sup> Edition; American Association of State Highway and Transportation Officials (AASHTO); Washington D.C.; 2018.

**Table 7**  
**SIGHT DISTANCE MEASUREMENTS<sup>a</sup>**

Intersection/Sight Distance Measurement	Distances (Feet)		
	Required Minimum (SSD)	Desirable (ISD) <sup>b</sup>	Measured
<b>Route 122 at Site Drive A</b>			
<i>Stopping Sight Distance:</i>			
Route 122 approaching from the east	335 <sup>c</sup>	--	500+
Route 122 approaching from the west	305 <sup>d</sup>	--	500+
<i>Intersection Sight Distance:</i>			
Looking to the east from the Project Site Drive A	--	475 <sup>c</sup>	500+
Looking to the west from the Project Site Drive A	--	445 <sup>d</sup>	500+
<b>Route 122 at Site Drive C</b>			
<i>Stopping Sight Distance:</i>			
Route 122 approaching from the east	335 <sup>c</sup>	--	500+
Route 122 approaching from the west	305 <sup>d</sup>	--	473
<i>Intersection Sight Distance:</i>			
Looking to the east from the Project Site Drive C	--	475 <sup>c</sup>	500+
Looking to the west from the Project Site Drive C	--	445 <sup>d</sup>	442

<sup>a</sup>Recommended minimum values obtained from *A Policy on Geometric Design of Highways and Streets*, 7<sup>th</sup> Edition; American Association of State Highway and Transportation Officials (AASHTO); 2018.

<sup>b</sup>Values shown are the intersection sight distance for a vehicle turning right or left exiting a roadway under STOP control such that motorists approaching the intersection on the major street should not need to adjust their travel speed to less than 70 percent of their initial approach speed.

<sup>c</sup>Based on 85<sup>th</sup> percentile speed of 43 mph.

<sup>d</sup>Based on 85<sup>th</sup> percentile speed of 40 mph.

As can be seen in Table 7, the sight distance at the Site Drive A intersection with Route 122 was found to exceed the recommended minimum sight distances, based on the vehicle travel speed of 40 and 45 mph. The available lines of sight at the Project Site Drive A will meet or exceed the recommended minimum sight distance to function in a safe manner.

The Site Drive C intersection with Route 122 was also found to exceed the recommended minimum for SSDs in both direction and for intersection sight distance in the east direction. Measured ISD in the west direction shows to not exceed recommend minimum distances, based on the 85<sup>th</sup> percentile vehicle travel speed of 40 mph. However, based on AASHTO standards if the measured ISD is greater than the required SSD value the intersection can operate in a safe manner, which is the case with this driveway.

## **TRAFFIC OPERATIONS ANALYSIS**

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Measuring existing and future traffic volumes quantifies traffic flow within the study area. To assess quality of flow, roadway capacity and vehicle queue analyses were conducted under Existing, No-Build, and Build traffic-volume conditions. Capacity analyses provide an indication of how well the roadway facilities serve the traffic demands placed upon them, with vehicle queue analyses providing a secondary measure of the operational characteristics of an intersection or section of roadway under study.

### **METHODOLOGY**

#### **Levels of Service**

A primary result of capacity analyses is the assignment of level-of-service to traffic facilities under various traffic-flow conditions.<sup>7</sup> The concept of level-of-service is defined as a qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers. A level-of-service definition provides an index to quality of traffic flow in terms of such factors as speed, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety.

Six levels of service are defined for each type of facility. They are given letter designations from A to F, with level-of-service (LOS) A representing the best operating conditions and LOS F representing congested or constrained operating conditions.

Since the level-of-service of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of levels of service, depending on the time of day, day of week, or period of year.

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<sup>7</sup>The capacity analysis methodology is based on the concepts and procedures presented in the *Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2010.

## **Signalized Intersections**

The six levels of service for signalized intersections may be described as follows:

- *LOS A* describes operations with very low control delay; most vehicles do not stop at all.
- *LOS B* describes operations with relatively low control delay. However, more vehicles stop than *LOS A*.
- *LOS C* describes operations with higher control delays. Individual cycle failures may begin to appear. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.
- *LOS D* describes operations with control delay in the range where the influence of congestion becomes more noticeable. Many vehicles stop, and individual cycle failures are noticeable.
- *LOS E* describes operations with high control delay values. Individual cycle failures are frequent occurrences.
- *LOS F* describes operations with high control delay values that often occur with oversaturation. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

Levels of service for signalized intersections were calculated using the Percentile Delay Method implemented as a part of the Synchro™ 10 software as required by MassDOT. The Percentile Delay Method assesses the effects of signal type, timing, phasing, and progression; vehicle mix; and geometrics on “percentile” delay. Level-of-service designations are based on the criterion of percentile delay per vehicle and is a measure of: i) driver discomfort; ii) motorist frustration; and iii) fuel consumption; and includes a uniform delay based on percentile volumes using a Poisson arrival pattern, an initial queue move-up time, and a queue interaction delay that accounts for delays resulting from queues extending from adjacent intersections. Table 8 summarizes the relationship between level-of-service and percentile delay and uses the same numerical delay thresholds as the 2000 *Highway Capacity Manual*<sup>8</sup> method. The tabulated percentile delay criterion may be applied in assigning level-of-service designations to individual lane groups, to individual intersection approaches, or to entire intersections.

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<sup>8</sup>*Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2000.

**Table 8**  
**LEVEL-OF-SERVICE CRITERIA**  
**FOR SIGNALIZED INTERSECTIONS**

Level of Service	Percentile Delay Per Vehicle (Seconds)
A	≤10.0
B	10.1 to 20.0
C	20.1 to 35.0
D	35.1 to 55.0
E	55.1 to 80.0
F	>80.0

### Unsignalized Intersections

The six levels of service for unsignalized intersections may be described as follows:

- *LOS A* represents a condition with little or no control delay to minor street traffic.
- *LOS B* represents a condition with short control delays to minor street traffic.
- *LOS C* represents a condition with average control delays to minor street traffic.
- *LOS D* represents a condition with long control delays to minor street traffic.
- *LOS E* represents operating conditions at or near capacity level, with very long control delays to minor street traffic.
- *LOS F* represents a condition where minor street demand volume exceeds capacity of an approach lane, with extreme control delays resulting.

The levels of service of unsignalized intersections are determined by application of a procedure described in the 2010 *Highway Capacity Manual*.<sup>9</sup> Level of service is measured in terms of average control delay. Mathematically, control delay is a function of the capacity and degree of saturation of the lane group and/or approach under study and is a quantification of motorist delay associated with traffic control devices such as traffic signals and STOP signs. Control delay includes the effects of initial deceleration delay approaching a STOP sign, stopped delay, queue move-up time, and final acceleration delay from a stopped condition. Definitions for level of service at unsignalized intersections are also given in the 2010 *Highway Capacity Manual*. Table 9 summarizes the relationship between level of service and average control delay for two-way stop controlled and all-way stop controlled intersections.

<sup>9</sup>*Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2010.

**Table 9**  
**LEVEL-OF-SERVICE CRITERIA FOR**  
**UNSIGNALIZED INTERSECTIONS<sup>a</sup>**

Level-of-Service by Volume-to-Capacity Ratio		Average Control Delay (Seconds Per Vehicle)
$v/c \leq 1.0$	$v/c > 1.0$	
A	F	$\leq 10.0$
B	F	10.1 to 15.0
C	F	15.1 to 25.0
D	F	25.1 to 35.0
E	F	35.1 to 50.0
F	F	$> 50.0$

<sup>a</sup>Source: *Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2010; page 19-2.

## **ANALYSIS RESULTS**

Level-of-service and vehicle queue analyses were conducted for 2021 Existing, 2028 No-Build, and 2028 Build conditions for the intersections within the study area. The results of the intersection capacity and vehicle queue analyses are summarized for signalized intersections in Table 10 and for unsignalized intersections in Table 11 with the detailed analysis results presented in the Appendix. The following is a summary of the level-of-service and delay analyses for the intersections within the study area:

### **Signalized Intersection**

#### **Route 122 at Massachusetts Turnpike (I-90) Westbound Ramp (Exit 11)**

Under all conditions, this signalized intersection will operate at an overall LOS B during the weekday morning peak hour and at an overall LOS D during the weekday evening peak. It is noteworthy that the level of service remains the same under future No-Build and Build conditions. The Project-related impacts generally defined an increase in motorist delay that resulted in a corresponding increase in vehicle queuing of 1 vehicle during the weekday morning peak hour and 2 vehicles during the weekday evening peak hour.

### **Unsignalized Intersections**

#### **Route 122 at Site Drive A**

Under Existing and No-Build conditions, the movements at this unsignalized intersection will operate at an overall LOS B or better during the weekday morning peak hour and at an overall LOS A during the weekday evening peak hour. Under Build conditions, the movements at this intersection will operate at an overall LOS C or better during the weekday morning peak hour and at an overall LOS D during the weekday evening peak hour. The operating conditions (LOS D) are direct result of the large volume of conflicting traffic traveling along Route 122.

### **Route 122 at Brigham Hill Road/Site Drive B (To Be Eliminated)**

Under all conditions, the movements at this unsignalized intersection will operate at an overall LOS F or better during the weekday morning and evening peak hours. It is important to note that this intersection serves as a route for vehicles traveling from downtown Millbury through Brigham Hill Road, with a potential destination to Worcester Center (left turn onto Route 122). Independent of the Project, the movements at this intersection operate and will continue to operate at an overall LOS F. As part of this development, the existing Wyman-Gordon driveway will be closed. Eliminating one leg of this intersection will be beneficial and will improve queues and delays.

### **Route 122 at Hilltop Street/ Site Drive C**

Under Existing conditions, the movements at this unsignalized intersection will operate at an overall LOS C or better during the weekday morning peak hour and at an overall LOS D during the weekday evening peak hour. Under No-Build conditions, the movements at this intersection will operate at an overall LOS D or better during the weekday morning peak hour and at an overall LOS E during the weekday evening peak hour. Under Build conditions, the movements at this intersection will operate at an overall LOS E or better during the weekday morning peak hour and at an overall LOS F during the weekday evening peak hour. The operating conditions (LOS F) are a direct result of the large volume of conflicting traffic traveling along Route 122 and are typical of operating conditions for side driveways at unsignalized intersections along roadways with similar traffic volumes and characteristics as those along Route 122. It should be noted that actual delays for vehicles exiting the site driveway will be less than predicted by the analysis model due to gaps created in the traffic stream along Route 122 created by the traffic signal at the Exit 11 interchange.

**Table 10**  
**SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY**

Signalized Intersection/Peak Hour/Movement	2021 Existing			2028 No-Build			2028 Build					
	V/C <sup>a</sup>	Delay <sup>b</sup>	LOS <sup>c</sup>	Queue <sup>d</sup> Avg/95 <sup>th</sup>	V/C	Delay	LOS	Queue Avg/95 <sup>th</sup>	V/C	Delay	LOS	Queue Avg/95 <sup>th</sup>
<b>Route 122 at I-90 WB Ramp (Exit 11)</b>												
<i>Weekday Morning:</i>												
Route 122 EB TH	0.61	26.0	C	86/173	0.64	27.2	C	98/185	0.65	27.5	C	103/191
Route 122 EB TH	0.48	4.10	A	29/63	0.52	5.00	A	41/85	0.52	5.20	A	43/88
Route 122 EB TH	0.67	18.1	B	64/159	0.75	23.1	C	75/194	0.78	25.0	C	78/206
Route 122 WB LT	0.39	10.8	B	72/154	0.42	11.6	B	85/165	0.43	11.6	B	86/167
Route 122 WB TH	0.71	26.8	C	119/215	0.74	28.0	C	134/239	0.74	28.4	C	136/243
I-90 Ramp NB LT	0.19	0.20	A	0/0	0.2	0.30	A	0/0	0.21	0.30	A	0/0
I-90 Ramp NB RT	--	<b>13.8</b>	<b>B</b>	--	--	<b>15.3</b>	<b>B</b>	--	--	<b>15.6</b>	<b>B</b>	--
<b>Overall</b>												
<i>Weekday Evening:</i>												
Route 122 EB TH	0.87	39.2	D	251/402	0.9	42.7	D	277/449	0.91	43.0	D	280/453
Route 122 EB TH	0.36	3.70	A	37/58	0.39	4.20	A	45/69	0.39	4.40	A	48/73
Route 122 WB LT	0.99	69.0	E	108/275	1.08	>80.0	F	145/309	1.17	>80.0	F	174/342
Route 122 WB TH	0.43	11.8	B	114/177	0.45	12.1	B	125/193	0.46	12.2	B	129/199
I-90 Ramp NB LT	1.02	71.5	E	350/480	1.12	>80.0	F	399/529	1.12	>80.0	F	399/529
I-90 Ramp NB RT	0.22	0.30	A	0/0	0.24	0.30	A	0/0	0.24	0.30	A	0/0
<b>Overall</b>	--	<b>35.1</b>	<b>D</b>	--	--	<b>46.0</b>	<b>D</b>	--	--	<b>50.2</b>	<b>D</b>	--

<sup>a</sup>Volume-to-capacity ratio.

<sup>b</sup>Control (signal) delay per vehicle in seconds.

<sup>c</sup>Level of service.

<sup>d</sup>Queue length in feet.

NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

**Table 11**  
**UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY**

Unsignalized Intersection/ Peak Hour/Movement	2021 Existing			2028 No-Build			2028 Build			Queue 95 <sup>th</sup> Percentile		
	Demand <sup>a</sup>	Delay <sup>b</sup>	LOS <sup>c</sup>	Demand	Delay	LOS	Demand	Delay	LOS			
<b>Route 122 at Site Drive A</b>												
<i>Weekday Morning:</i>												
Route 122 EB LT	1	8.5	A	0.0	1	8.6	A	0.0	36	8.8	A	0.1
Site Driveway A	1	11.7	B	0.0	1	12.1	B	0.0	17	15.8	C	0.2
<i>Weekday Evening:</i>												
Route 122 EB LT	0	0.0	A	0.0	0	0.0	A	0.0	14	9.2	A	0.1
Site Driveway A	0	0.0	A	0.0	0	0.0	A	0.0	53	25.8	D	1.0
<b>Route 122 at Brigham Hill Road/Site Drive B</b>												
<i>Weekday Morning:</i>												
Route 122 WB LT									--	--	--	--
Route 122 EB LT	9	8.6	A	0.0	10	8.7	A	0.0			--	
Brigham Hill Road NB LT/TH/RT	14	8.6	A	0.0	14	8.7	A	0.0	11	8.8	A	0
Wyman-Gordon drive SB LT/TH/RT	158	>50.0	F	7.7	170	>50.0	F	10.3	172	>50.0	F	7.8
<i>Weekday Evening:</i>												
Route 122 WB LT	4	21.8	C	0.2	4	24.3	C	0.2	--	--	--	--
Route 122 EB LT	7	9.8	A	0.0	8	10.1	A	0.0	--	--	--	--
Brigham Hill Road NB LT/TH/RT	3	8.9	A	0.0	3	9.1	A	0.0	10	10.2	A	0
Site Drive SB LT/TH/RT	70	>50.0	F	4.8	74	>50.0	F	6.2	75	>50.0	F	4.4
	30	31.2	D	1.1	30	37.6	E	1.3	--	--	--	--
<b>Route 122 at Hilltop Street/Site Drive C</b>												
<i>Weekday Morning:</i>												
Route 122 WB LT	1	8.5	A	0.0	1	8.5	A	0.0	1	8.7	A	0.0
Route 122 EB LT	--	--	--	--	--	--	--	--	13	9.4	A	0.1
Hilltop Street NB LT/TH/RT	8	23.8	C	0.1	9	26.8	D	0.2	9	38.0	D	0.1
Site Drive C SB LT/TH/RT	--	--	--	--	--	--	--	--	3	30.9	E	0.3
<i>Weekday Evening:</i>												
Route 122 WB LT	2	9.8	A	0.0	2	10.1	B	0.0	2	10.2	A	0.0
Route 122 EB LT	--	--	--	--	--	--	--	--	3	9.5	B	0.0
Hilltop Street NB LT/TH/RT	13	34.4	D	0.7	14	42.6	E	0.9	14	>50.0	F	1.0
Site Drive C SB LT/TH/RT	--	--	--	--	--	--	--	--	29	47.7	E	1.4

<sup>a</sup>Demand in vehicles per hour.

<sup>b</sup>Control (signal) delay per vehicle in seconds.

<sup>c</sup>Level of service.

<sup>d</sup>Queue length in vehicle.

NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

## **CONCLUSIONS AND RECOMMENDATIONS**

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Vanasse & Associates, Inc. (VAI) has prepared this Transportation Impact Assessment (TIA) in order to evaluate potential traffic impacts associated with the proposed warehouse development to be located at 244 Worcester Street in Grafton, Massachusetts (the "Project"). This study was prepared in accordance with the Massachusetts Department of Transportation (MassDOT) Guidelines for *Transportation Impact Assessment (TIA) Guideline*; and was conducted pursuant to the standards of the Traffic Engineering and Transportation Planning Professions for the preparation of such reports. Based on the results of this study, the following can be concluded:

- The proposed 375,000 sf warehouse building is expected to generate approximately 638 new vehicle trips on an average weekday (two-way, 24-hour volume), with 64 new vehicle trips (49 entering and 15 exiting) expected during the weekday morning peak hour and 71 new vehicle trips (19 entering and 52 exiting) expected during the weekday evening peak hour.
- The analysis has indicated that the Project will result in minimal impact on motorist delays at the study intersections, as compared to future No-Build conditions.
- No apparent safety deficiencies were noted with respect to the motor vehicle crash history at the study area intersections.
- Lines of sight at the Project site roadway intersections with Route 122 were found to exceed or could be made to meet or exceed the recommended minimum distance for safe operation based on the appropriate approach speed.

In consideration of the above, we have concluded that the Project can be accommodated within the confines of the existing transportation infrastructure in a safe and efficient manner with the implementation of the following recommendations.

### **RECOMMENDATIONS**

The following recommendations have been developed as a part of this evaluation and, where applicable, will be completed in conjunction with the Project subject to receipt of all necessary rights, permits, and approvals.

## **Project Access**

Access and egress to the Project site will be provided by two full-access driveways onto Worcester Street (Route 122). The following recommendations are offered with respect to Project access, internal circulation, and parking, many of which are already reflected on the Site Plans for the Project:

- Vehicles exiting the Project site should be placed under STOP-sign control with a marked STOP-line provided.
- All signs and pavement markings to be installed within the Project site should conform to the applicable standards of the *Manual on Uniform Traffic Control Devices* (MUTCD).<sup>10</sup>
- Signs and landscaping to be installed as a part of the Project within intersection sight triangle areas of the Project site driveways should be designed and maintained so as not to restrict lines of sight.
- Snow windows within the sight triangle areas of the Project site driveways and at intersections within the Project site should be promptly removed where such accumulations would impede sight lines.

## **Off-Site Improvement**

### **Route 122 Traffic Calming**

**Speed Radar Signs.** The traffic data documented herein indicates that vehicles are traveling above the legally enforceable posted speed limit. One potential mitigation measure includes the installation of Dynamic Speed Feedback Signs along Route 122. Dynamic Speed Feedback Signs are radar activated signs that dynamically display approaching speeds for individual vehicles or display messages such as “SLOW DOWN” or “REDUCE SPEED” when a vehicle exceeds a certain speed. They alert drivers that they are speeding and create a sense of being monitored.

## **CONCLUSIONS**

The proposed Project will not result in a significant impact on overall operations. With the implementation of the above recommendations, safe and efficient access will be provided to the planned development and the proposed development can be constructed with minimal impact to the area as designed.

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<sup>10</sup>Ibid 2.

## APPENDIX

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SITE PLAN

TURNING MOVEMENT COUNTS

AUTOMATIC TRAFFIC RECORDER

VEHICLE TRAVEL SPEED MEASUREMENTS

TRAFFIC ADJUSTMENTS

PUBLIC TRANSPORTATION SCHEDULES

MOTOR VEHICLE CRASH DATA

GROWTH RATE CALCULATIONS

BACKGROUND DEVELOPMENT

WYMAN-GORDON TRIP REDISTRIBUTION

TRIP GENERATION

CAPACITY ANALYSIS

## SITE PLAN



## TURNING MOVEMENT COUNTS

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# Accurate Counts

978-664-2565

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 1

## Groups Printed- Cars - Trucks

	Wyman-Gordon South Dwy From North		Worcester St From East		Worcester St From West		
Start Time	Left	Right	Thru	Right	Left	Thru	Int. Total
07:00 AM	0	0	90	0	0	100	190
07:15 AM	0	0	117	0	0	87	204
07:30 AM	0	0	113	0	0	94	207
07:45 AM	0	1	88	0	1	112	202
Total	0	1	408	0	1	393	803
08:00 AM	0	0	102	0	0	100	202
08:15 AM	0	0	108	0	0	85	193
08:30 AM	0	0	85	0	0	82	167
08:45 AM	0	0	100	0	0	105	205
Total	0	0	395	0	0	372	767
Grand Total	0	1	803	0	1	765	1570
Apprch %	0	100	100	0	0.1	99.9	
Total %	0	0.1	51.1	0	0.1	48.7	
Cars	0	1	770	0	1	738	1510
% Cars	0	100	95.9	0	100	96.5	96.2
Trucks	0	0	33	0	0	27	60
% Trucks	0	0	4.1	0	0	3.5	3.8

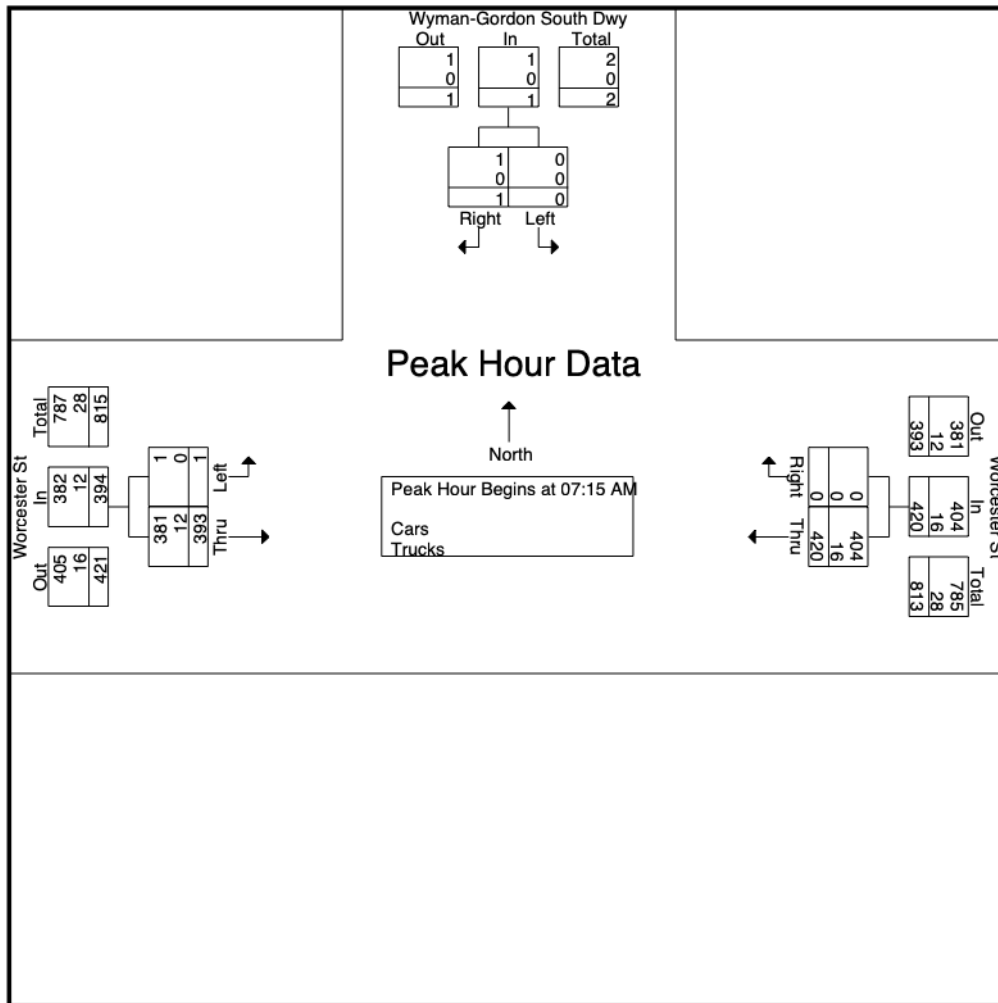
	Wyman-Gordon South Dwy From North			Worcester St From East			Worcester St From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:15 AM										
07:15 AM	0	0	0	117	0	117	0	87	87	204
07:30 AM	0	0	0	113	0	113	0	94	94	207
07:45 AM	0	1	1	88	0	88	1	112	113	202
08:00 AM	0	0	0	102	0	102	0	100	100	202
Total Volume	0	1	1	420	0	420	1	393	394	815
% App. Total	0	100		100	0		0.3	99.7		
PHF	.000	.250	.250	.897	.000	.897	.250	.877	.872	.984
Cars	0	1	1	404	0	404	1	381	382	787
% Cars	0	100	100	96.2	0	96.2	100	96.9	97.0	96.6
Trucks	0	0	0	16	0	16	0	12	12	28
% Trucks	0	0	0	3.8	0	3.8	0	3.1	3.0	3.4

# Accurate Counts

978-664-2565

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 2



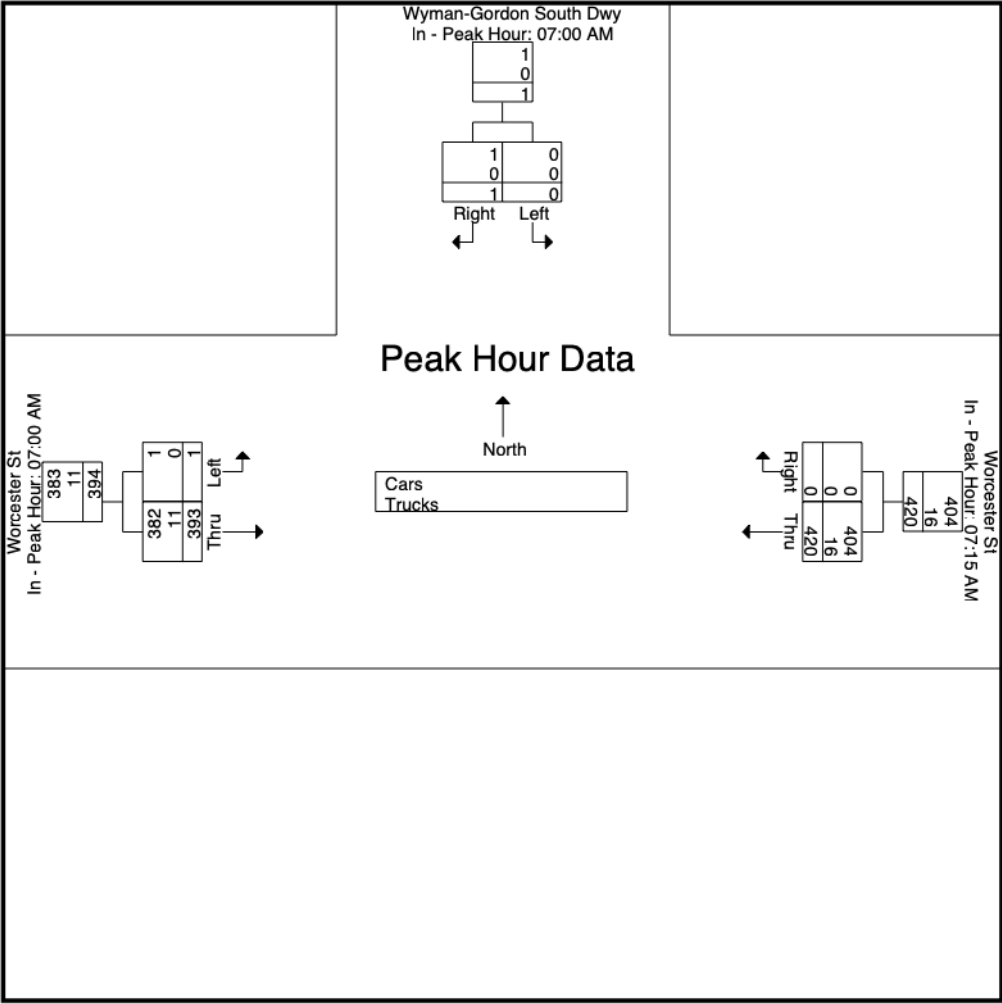
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	07:00 AM			07:15 AM			07:00 AM		
+0 mins.	0	0	0	117	0	117	0	100	100
+15 mins.	0	0	0	113	0	113	0	87	87
+30 mins.	0	0	0	88	0	88	0	94	94
+45 mins.	0	1	1	102	0	102	1	112	113
Total Volume	0	1	1	420	0	420	1	393	394
% App. Total	0	100		100	0		0.3	99.7	
PHF	.000	.250	.250	.897	.000	.897	.250	.877	.872
Cars	0	1	1	404	0	404	1	382	383
% Cars	0	100	100	96.2	0	96.2	100	97.2	97.2
Trucks	0	0	0	16	0	16	0	11	11
% Trucks	0	0	0	3.8	0	3.8	0	2.8	2.8

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 3



# Accurate Counts

978-664-2565

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 4

## Groups Printed- Cars

	Wyman-Gordon South Dwy From North		Worcester St From East		Worcester St From West		
Start Time	Left	Right	Thru	Right	Left	Thru	Int. Total
07:00 AM	0	0	88	0	0	97	185
07:15 AM	0	0	113	0	0	85	198
07:30 AM	0	0	109	0	0	92	201
07:45 AM	0	1	88	0	1	108	198
Total	0	1	398	0	1	382	782
08:00 AM	0	0	94	0	0	96	190
08:15 AM	0	0	103	0	0	82	185
08:30 AM	0	0	81	0	0	79	160
08:45 AM	0	0	94	0	0	99	193
Total	0	0	372	0	0	356	728
Grand Total	0	1	770	0	1	738	1510
Apprch %	0	100	100	0	0.1	99.9	
Total %	0	0.1	51	0	0.1	48.9	

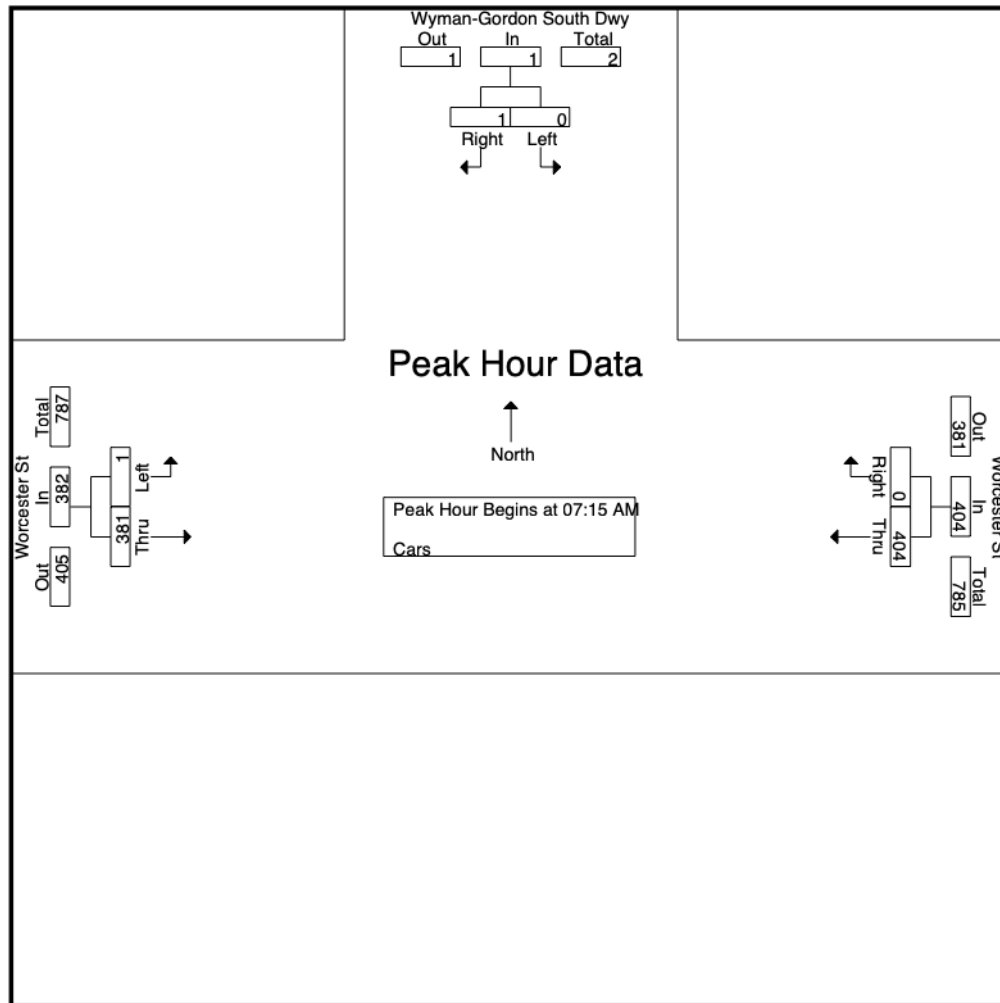
	Wyman-Gordon South Dwy From North			Worcester St From East			Worcester St From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:15 AM										
07:15 AM	0	0	0	113	0	113	0	85	85	198
07:30 AM	0	0	0	109	0	109	0	92	92	201
07:45 AM	0	1	1	88	0	88	1	108	109	198
08:00 AM	0	0	0	94	0	94	0	96	96	190
Total Volume	0	1	1	404	0	404	1	381	382	787
% App. Total	0	100		100	0		0.3	99.7		
PHF	.000	.250	.250	.894	.000	.894	.250	.882	.876	.979

# Accurate Counts

978-664-2565

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 5



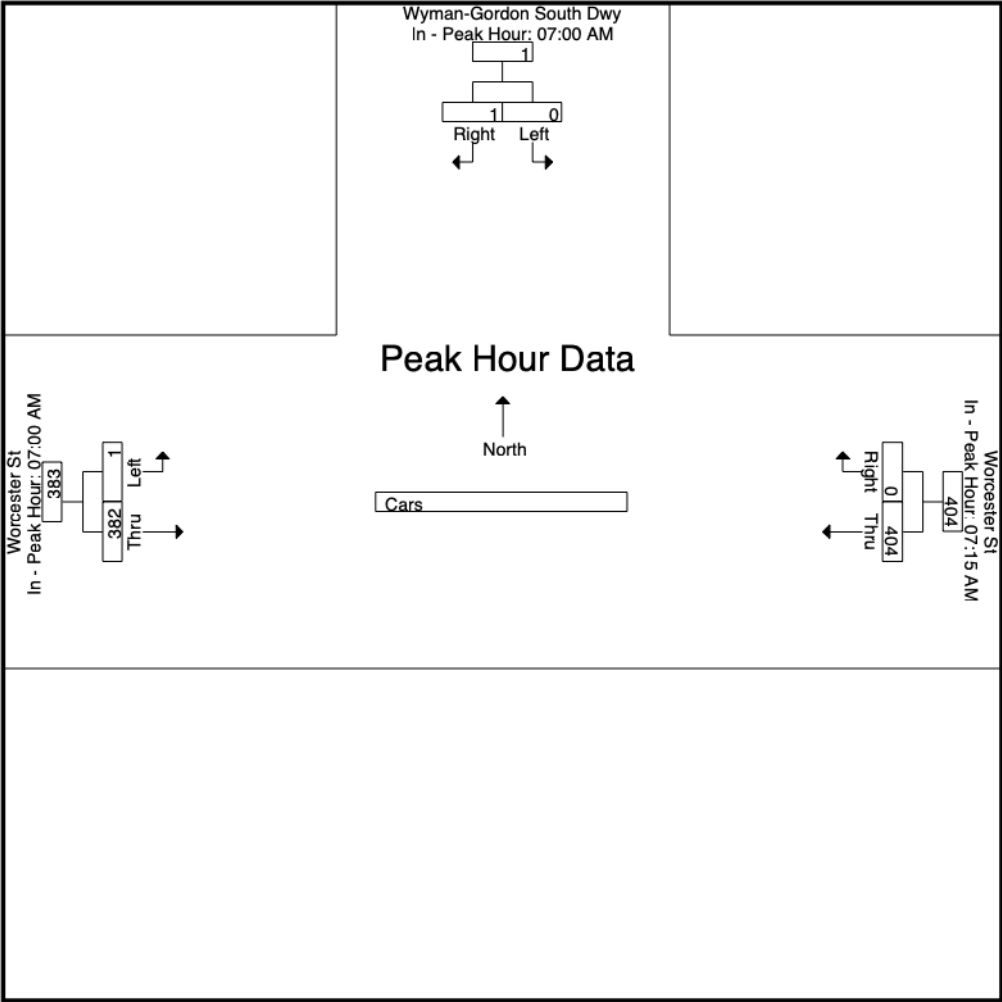
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	07:00 AM			07:15 AM			07:00 AM		
+0 mins.	0	0	0	113	0	113	0	97	97
+15 mins.	0	0	0	109	0	109	0	85	85
+30 mins.	0	0	0	88	0	88	0	92	92
+45 mins.	0	1	1	94	0	94	1	108	109
Total Volume	0	1	1	404	0	404	1	382	383
% App. Total	0	100		100	0		0.3	99.7	
PHF	.000	.250	.250	.894	.000	.894	.250	.884	.878

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 6



# Accurate Counts

978-664-2565

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 7

## Groups Printed- Trucks

	Wyman-Gordon South Dwy From North		Worcester St From East		Worcester St From West		
Start Time	Left	Right	Thru	Right	Left	Thru	Int. Total
07:00 AM	0	0	2	0	0	3	5
07:15 AM	0	0	4	0	0	2	6
07:30 AM	0	0	4	0	0	2	6
07:45 AM	0	0	0	0	0	4	4
Total	0	0	10	0	0	11	21
08:00 AM	0	0	8	0	0	4	12
08:15 AM	0	0	5	0	0	3	8
08:30 AM	0	0	4	0	0	3	7
08:45 AM	0	0	6	0	0	6	12
Total	0	0	23	0	0	16	39
Grand Total	0	0	33	0	0	27	60
Apprch %	0	0	100	0	0	100	
Total %	0	0	55	0	0	45	

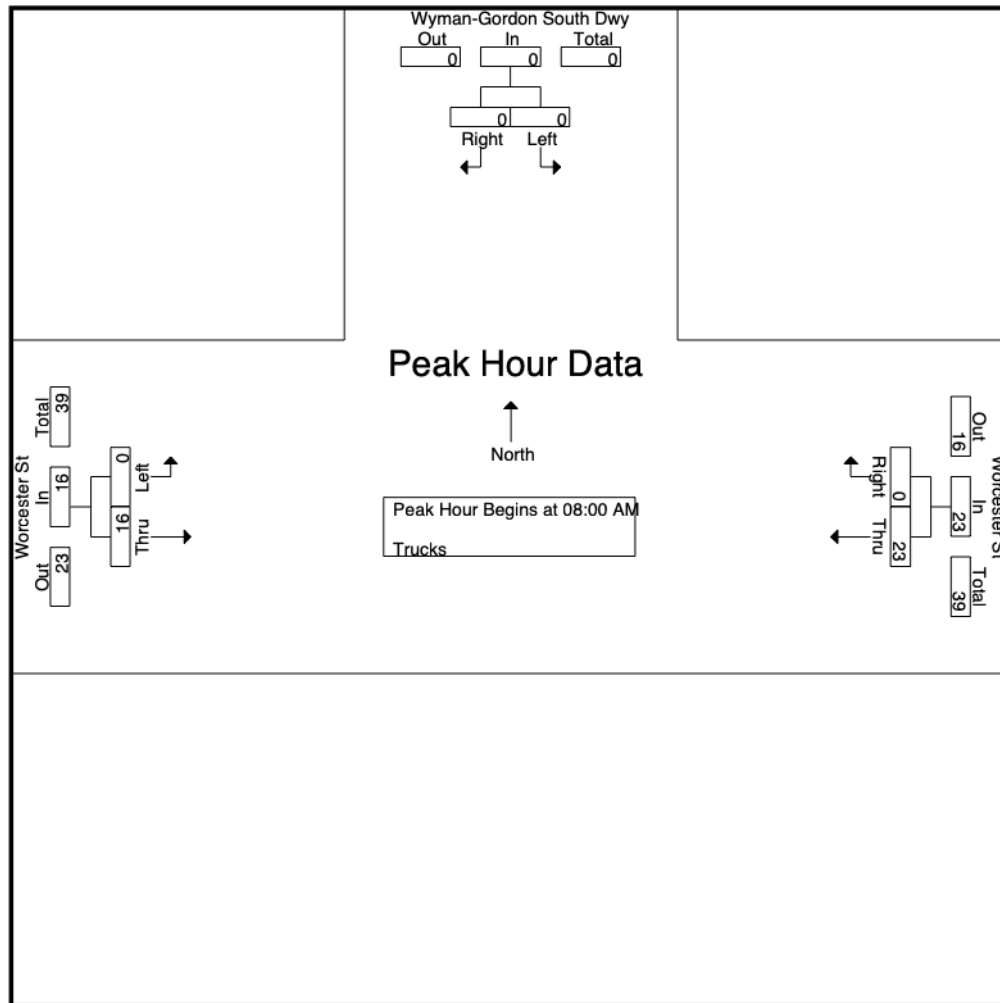
	Wyman-Gordon South Dwy From North			Worcester St From East			Worcester St From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 08:00 AM										
08:00 AM	0	0	0	8	0	8	0	4	4	12
08:15 AM	0	0	0	5	0	5	0	3	3	8
08:30 AM	0	0	0	4	0	4	0	3	3	7
08:45 AM	0	0	0	6	0	6	0	6	6	12
Total Volume	0	0	0	23	0	23	0	16	16	39
% App. Total	0	0		100	0		0	100		
PHF	.000	.000	.000	.719	.000	.719	.000	.667	.667	.813

# Accurate Counts

978-664-2565

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 8



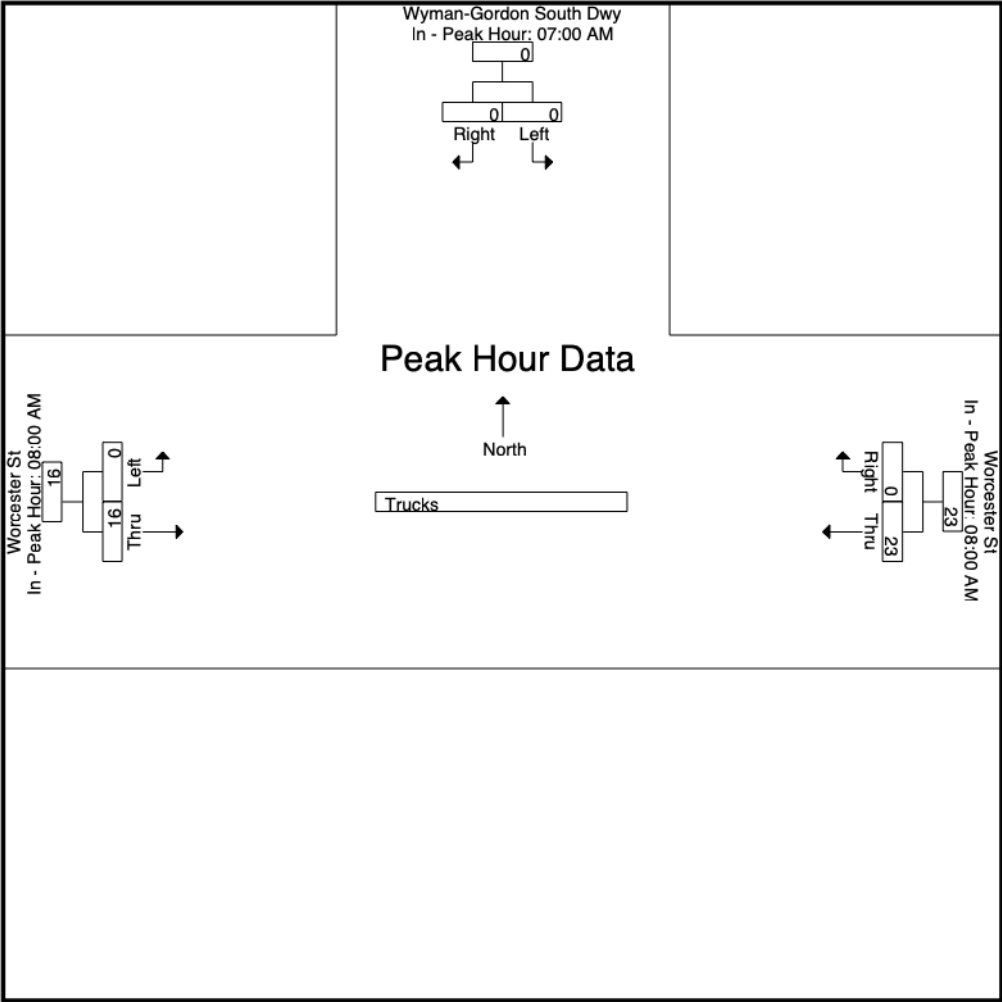
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	07:00 AM			08:00 AM			08:00 AM		
+0 mins.	0	0	0	8	0	8	0	4	4
+15 mins.	0	0	0	5	0	5	0	3	3
+30 mins.	0	0	0	4	0	4	0	3	3
+45 mins.	0	0	0	6	0	6	0	6	6
Total Volume	0	0	0	23	0	23	0	16	16
% App. Total	0	0	0	100	0	100	0	100	100
PHF	.000	.000	.000	.719	.000	.719	.000	.667	.667

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 9



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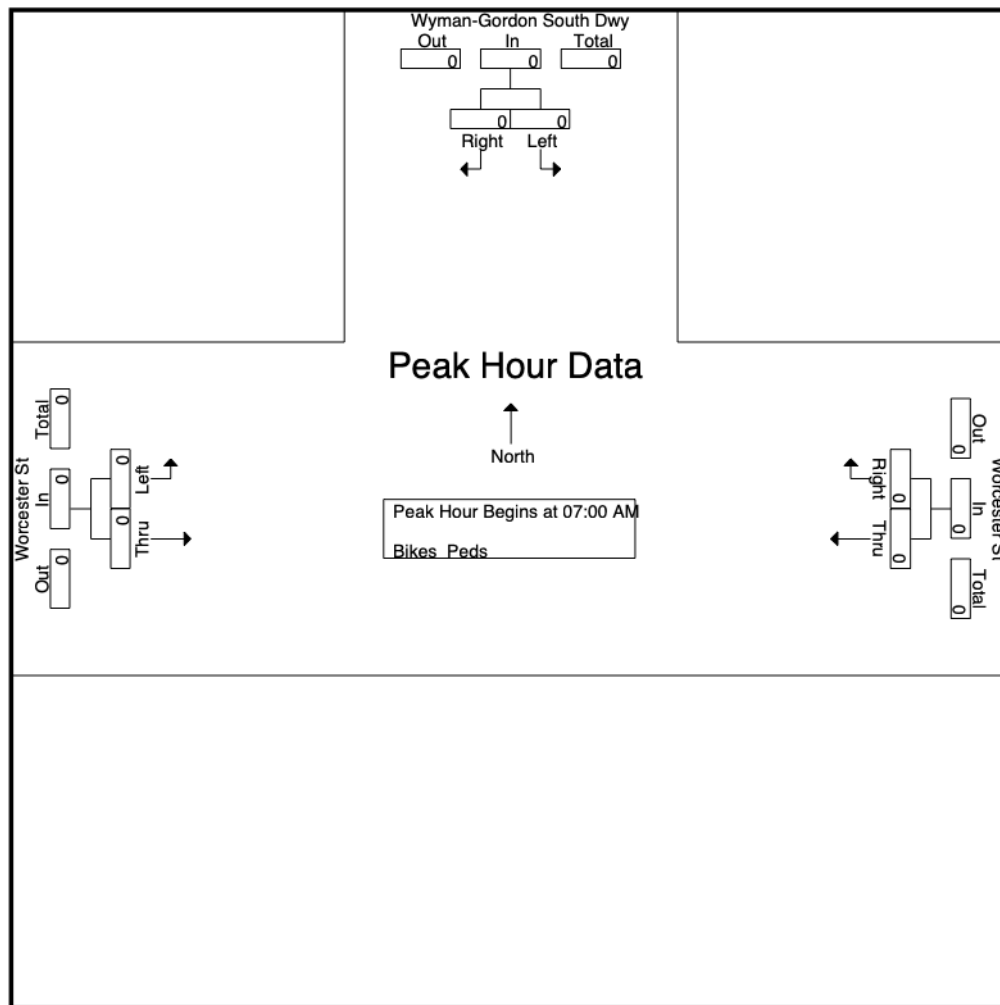
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Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 10

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978-664-2565

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 11

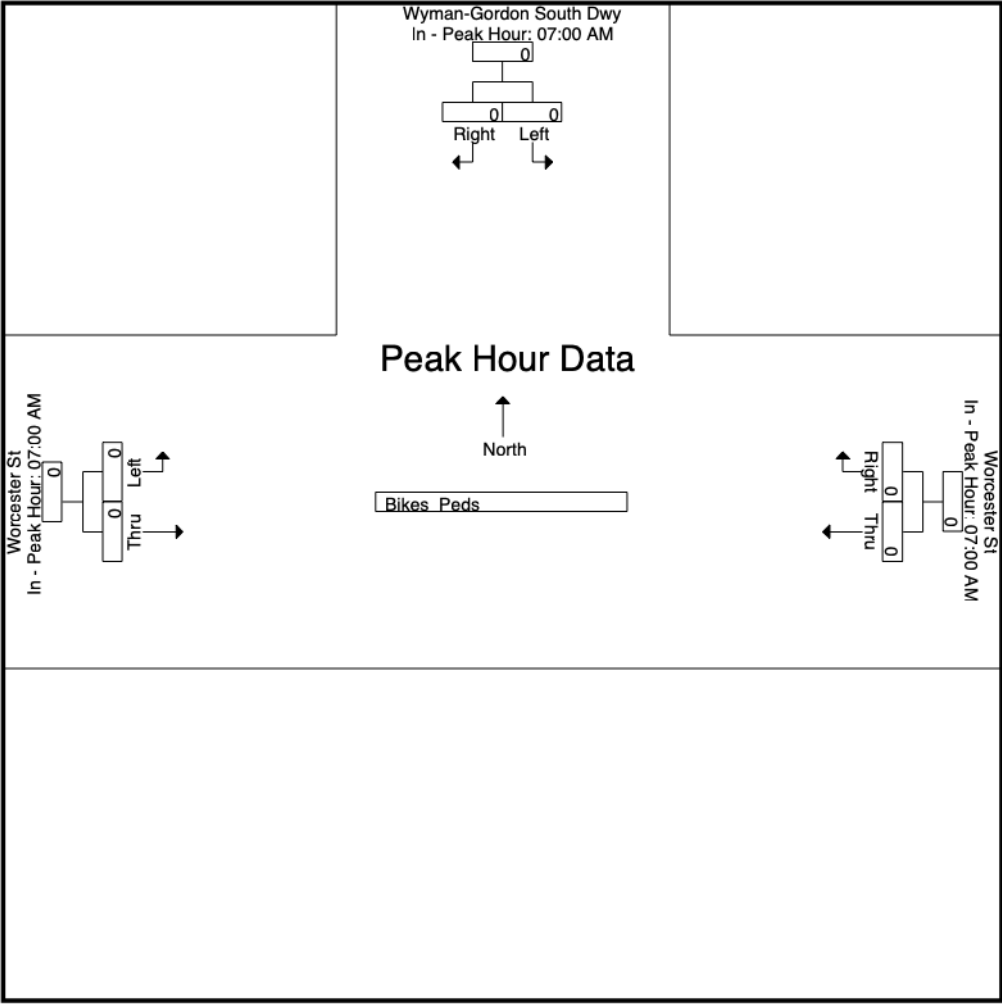


Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1  
Peak Hour for Each Approach Begins at:

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N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 12



# Accurate Counts

978-664-2565

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 1

## Groups Printed- Cars - Trucks

	Wyman-Gordon South Dwy From North		Worcester St From East		Worcester St From West		
Start Time	Left	Right	Thru	Right	Left	Thru	Int. Total
04:00 PM	0	0	137	0	0	133	270
04:15 PM	0	0	147	0	0	128	275
04:30 PM	0	0	117	0	0	157	274
04:45 PM	0	0	123	0	0	160	283
Total	0	0	524	0	0	578	1102
05:00 PM	0	0	128	0	0	133	261
05:15 PM	0	0	135	0	0	131	266
05:30 PM	0	0	111	0	0	107	218
05:45 PM	0	0	113	0	0	116	229
Total	0	0	487	0	0	487	974
Grand Total	0	0	1011	0	0	1065	2076
Apprch %	0	0	100	0	0	100	
Total %	0	0	48.7	0	0	51.3	
Cars	0	0	994	0	0	1054	2048
% Cars	0	0	98.3	0	0	99	98.7
Trucks	0	0	17	0	0	11	28
% Trucks	0	0	1.7	0	0	1	1.3

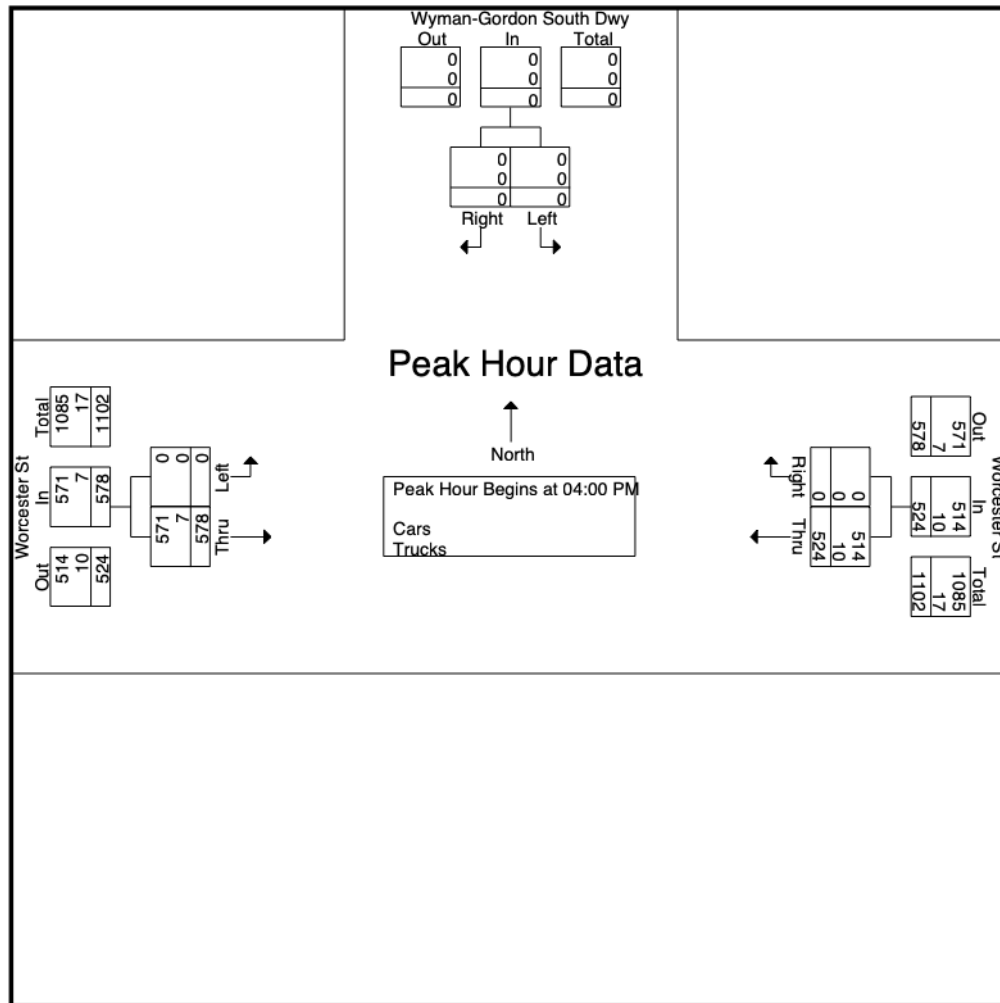
	Wyman-Gordon South Dwy From North			Worcester St From East			Worcester St From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:00 PM										
04:00 PM	0	0	0	137	0	137	0	133	133	270
04:15 PM	0	0	0	147	0	147	0	128	128	275
04:30 PM	0	0	0	117	0	117	0	157	157	274
04:45 PM	0	0	0	123	0	123	0	160	160	283
Total Volume	0	0	0	524	0	524	0	578	578	1102
% App. Total	0	0	0	100	0	100	0	100		
PHF	.000	.000	.000	.891	.000	.891	.000	.903	.903	.973
Cars	0	0	0	514	0	514	0	571	571	1085
% Cars	0	0	0	98.1	0	98.1	0	98.8	98.8	98.5
Trucks	0	0	0	10	0	10	0	7	7	17
% Trucks	0	0	0	1.9	0	1.9	0	1.2	1.2	1.5

# Accurate Counts

978-664-2565

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 2



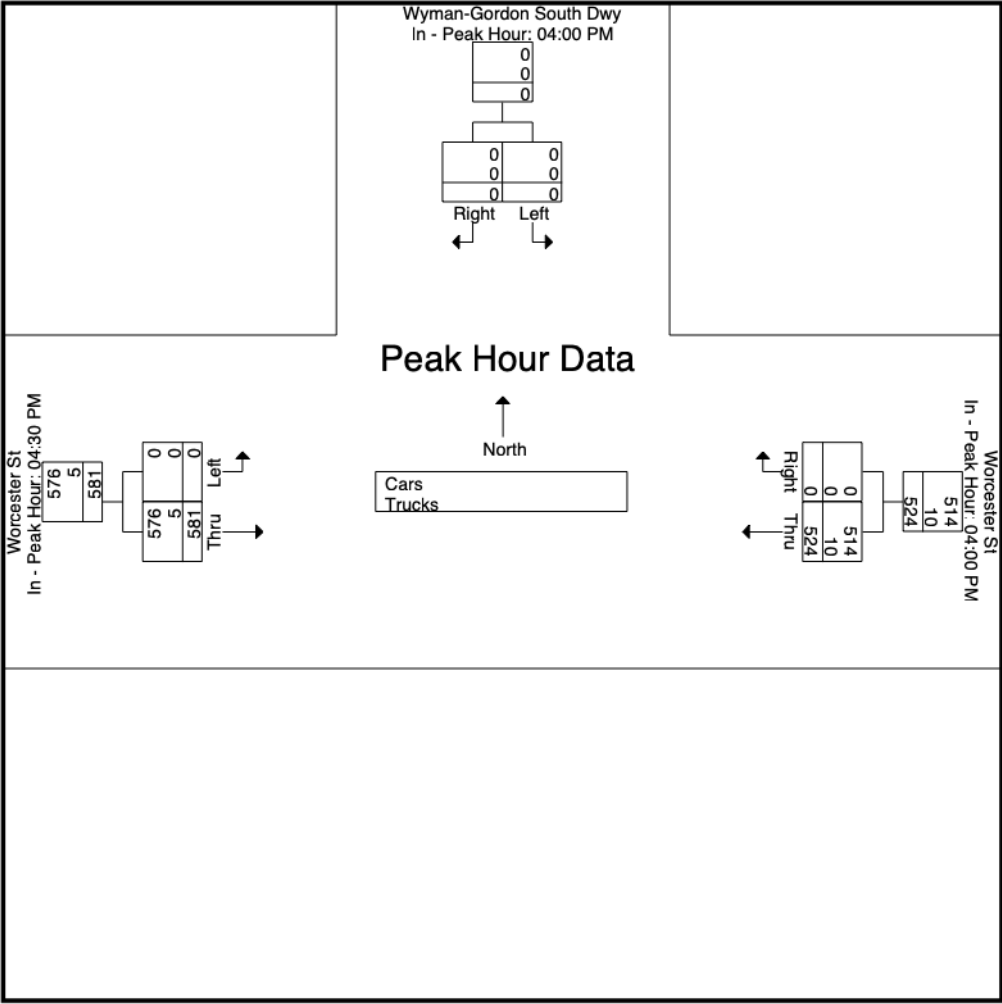
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	04:00 PM			04:00 PM			04:30 PM		
+0 mins.	0	0	0	137	0	137	0	157	157
+15 mins.	0	0	0	147	0	147	0	160	160
+30 mins.	0	0	0	117	0	117	0	133	133
+45 mins.	0	0	0	123	0	123	0	131	131
Total Volume	0	0	0	524	0	524	0	581	581
% App. Total	0	0	0	100	0	100	0	100	100
PHF	.000	.000	.000	.891	.000	.891	.000	.908	.908
Cars	0	0	0	514	0	514	0	576	576
% Cars	0	0	0	98.1	0	98.1	0	99.1	99.1
Trucks	0	0	0	10	0	10	0	5	5
% Trucks	0	0	0	1.9	0	1.9	0	0.9	0.9

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 3



# Accurate Counts

978-664-2565

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 4

## Groups Printed- Cars

	Wyman-Gordon South Dwy From North		Worcester St From East		Worcester St From West		
Start Time	Left	Right	Thru	Right	Left	Thru	Int. Total
04:00 PM	0	0	134	0	0	130	264
04:15 PM	0	0	143	0	0	127	270
04:30 PM	0	0	116	0	0	155	271
04:45 PM	0	0	121	0	0	159	280
Total	0	0	514	0	0	571	1085
05:00 PM	0	0	127	0	0	132	259
05:15 PM	0	0	134	0	0	130	264
05:30 PM	0	0	108	0	0	107	215
05:45 PM	0	0	111	0	0	114	225
Total	0	0	480	0	0	483	963
Grand Total	0	0	994	0	0	1054	2048
Apprch %	0	0	100	0	0	100	
Total %	0	0	48.5	0	0	51.5	

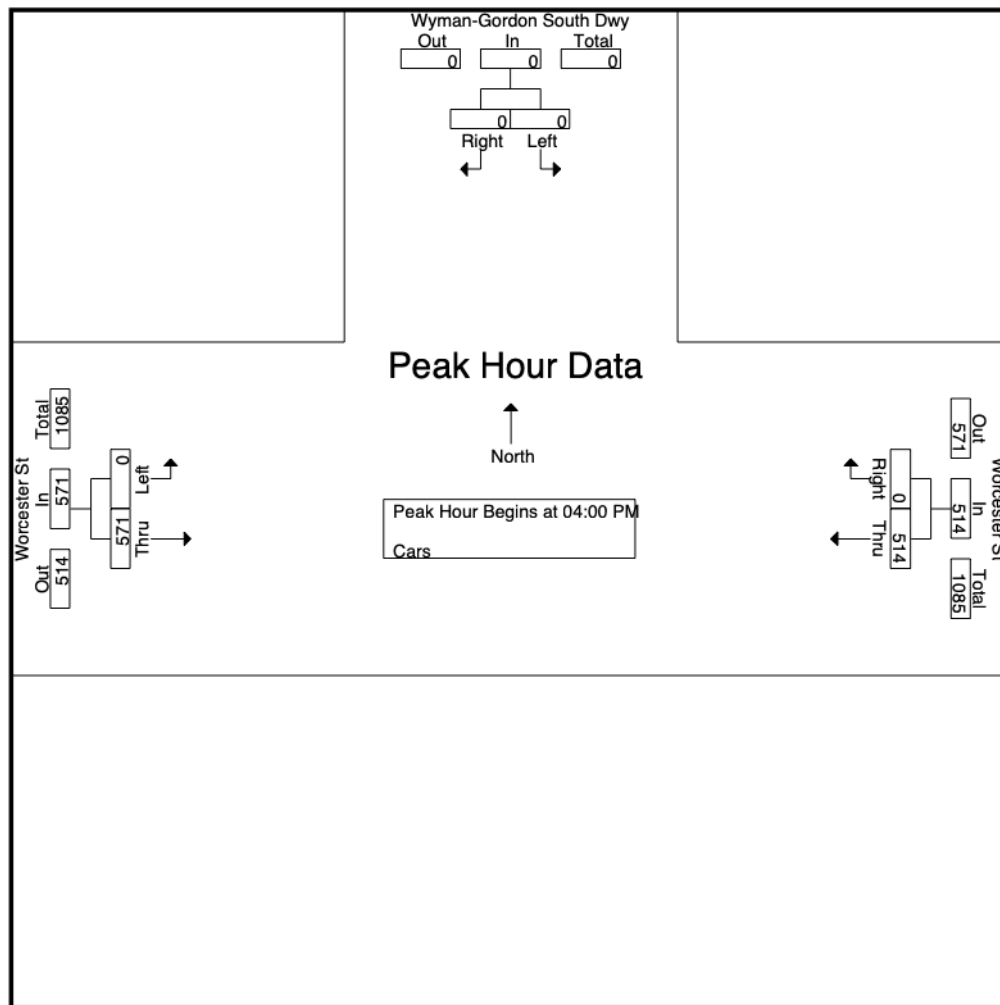
	Wyman-Gordon South Dwy From North			Worcester St From East			Worcester St From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:00 PM										
04:00 PM	0	0	0	134	0	134	0	130	130	264
04:15 PM	0	0	0	143	0	143	0	127	127	270
04:30 PM	0	0	0	116	0	116	0	155	155	271
04:45 PM	0	0	0	121	0	121	0	159	159	280
Total Volume	0	0	0	514	0	514	0	571	571	1085
% App. Total	0	0		100	0		0	100		
PHF	.000	.000	.000	.899	.000	.899	.000	.898	.898	.969

# Accurate Counts

978-664-2565

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 5



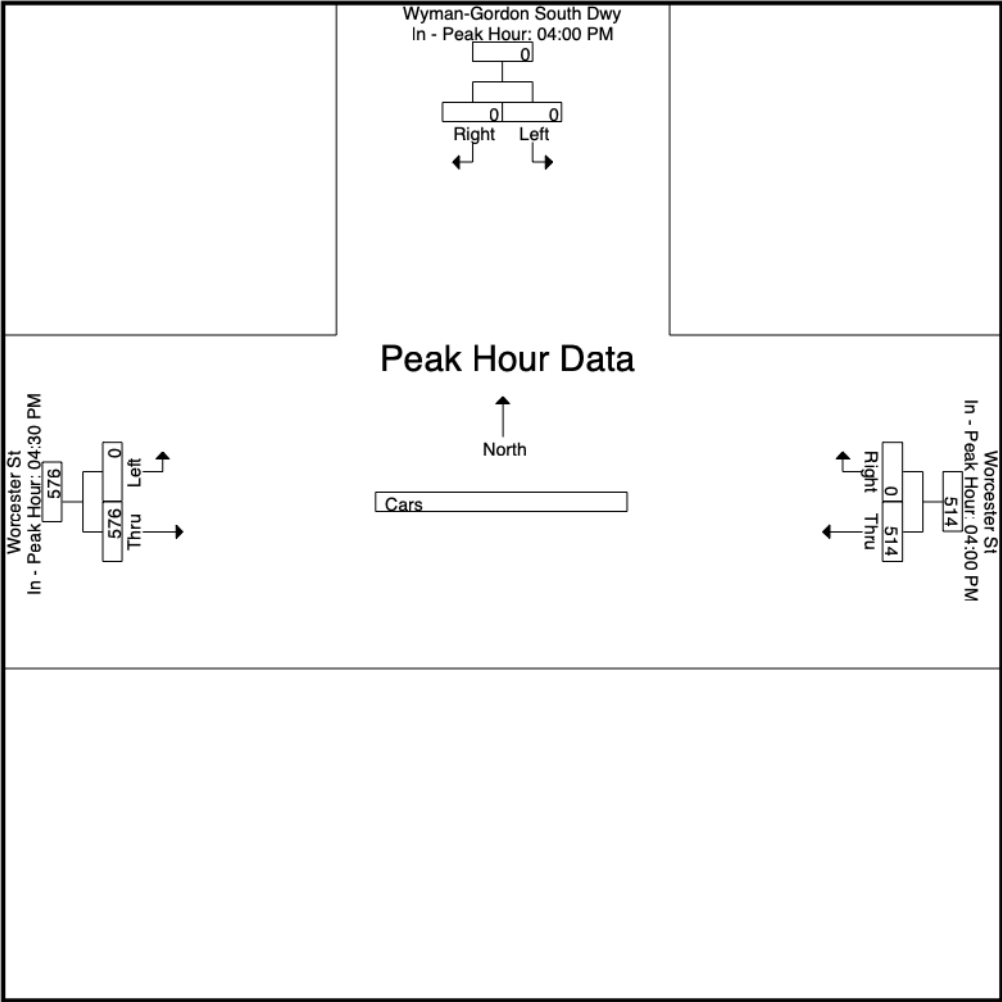
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	04:00 PM			04:00 PM			04:30 PM		
+0 mins.	0	0	0	134	0	134	0	155	155
+15 mins.	0	0	0	<b>143</b>	0	<b>143</b>	0	<b>159</b>	<b>159</b>
+30 mins.	0	0	0	116	0	116	0	132	132
+45 mins.	0	0	0	121	0	121	0	130	130
Total Volume	0	0	0	514	0	514	0	576	576
% App. Total	0	0	0	100	0	100	0	100	100
PHF	.000	.000	.000	.899	.000	.899	.000	.906	.906

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 6



# Accurate Counts

978-664-2565

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 7

## Groups Printed- Trucks

	Wyman-Gordon South Dwy From North		Worcester St From East		Worcester St From West		
Start Time	Left	Right	Thru	Right	Left	Thru	Int. Total
04:00 PM	0	0	3	0	0	3	6
04:15 PM	0	0	4	0	0	1	5
04:30 PM	0	0	1	0	0	2	3
04:45 PM	0	0	2	0	0	1	3
Total	0	0	10	0	0	7	17
05:00 PM	0	0	1	0	0	1	2
05:15 PM	0	0	1	0	0	1	2
05:30 PM	0	0	3	0	0	0	3
05:45 PM	0	0	2	0	0	2	4
Total	0	0	7	0	0	4	11
Grand Total	0	0	17	0	0	11	28
Apprch %	0	0	100	0	0	100	
Total %	0	0	60.7	0	0	39.3	

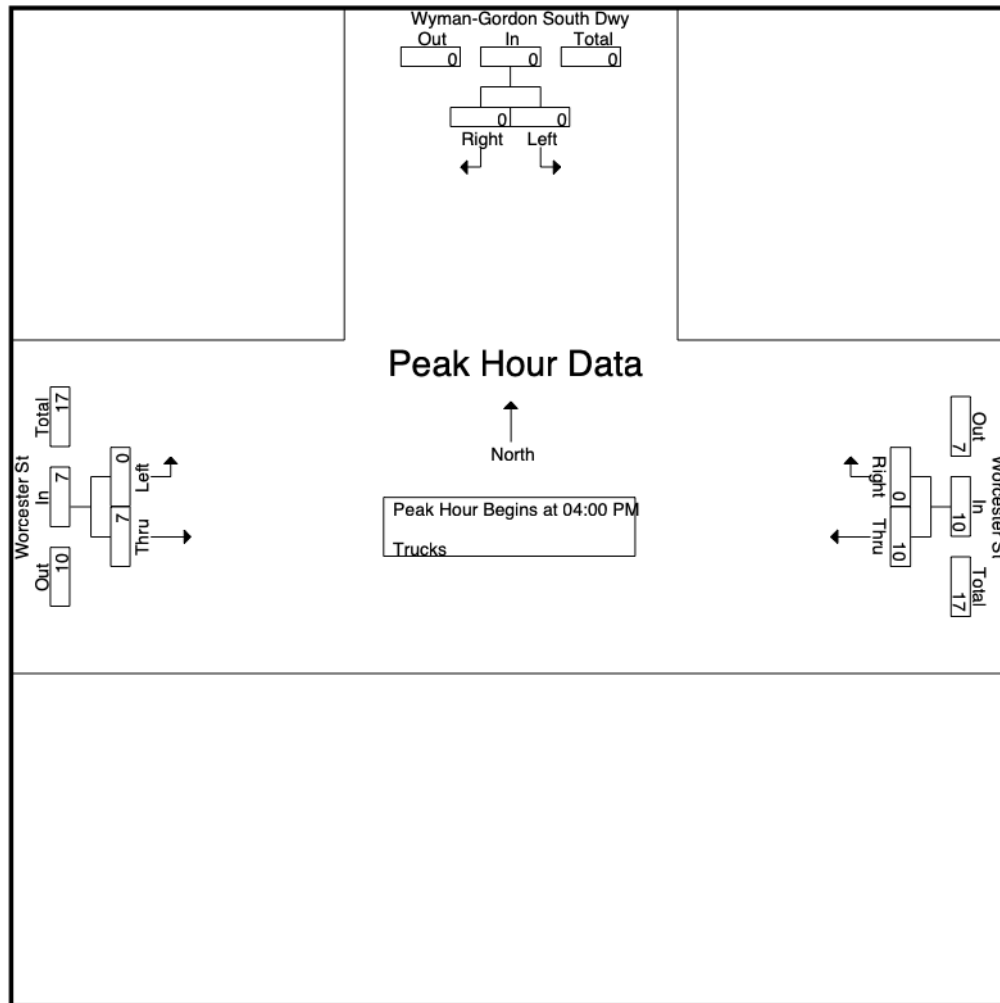
	Wyman-Gordon South Dwy From North			Worcester St From East			Worcester St From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:00 PM										
04:00 PM	0	0	0	3	0	3	0	3	3	6
04:15 PM	0	0	0	4	0	4	0	1	1	5
04:30 PM	0	0	0	1	0	1	0	2	2	3
04:45 PM	0	0	0	2	0	2	0	1	1	3
Total Volume	0	0	0	10	0	10	0	7	7	17
% App. Total	0	0		100	0		0	100		
PHF	.000	.000	.000	.625	.000	.625	.000	.583	.583	.708

# Accurate Counts

978-664-2565

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 8



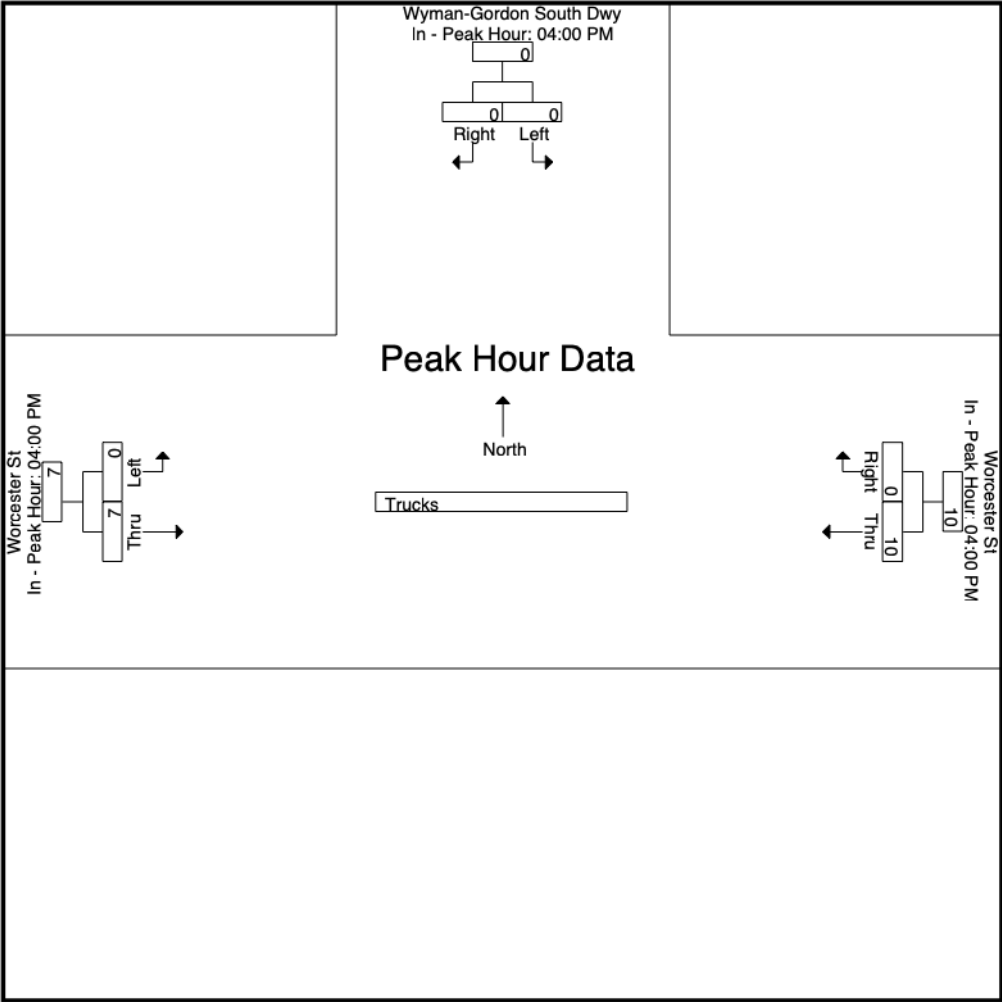
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	04:00 PM			04:00 PM			04:00 PM		
+0 mins.	0	0	0	3	0	3	0	3	3
+15 mins.	0	0	0	4	0	4	0	1	1
+30 mins.	0	0	0	1	0	1	0	2	2
+45 mins.	0	0	0	2	0	2	0	1	1
Total Volume	0	0	0	10	0	10	0	7	7
% App. Total	0	0	0	100	0	100	0	100	100
PHF	.000	.000	.000	.625	.000	.625	.000	.583	.583

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 9



# Accurate Counts

978-664-2565

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 10

## Groups Printed- Bikes Peds

	Wyman-Gordon South Dwy From North			Worcester St From East			Worcester St From West					
Start Time	Left	Right	Peds	Thru	Right	Peds	Left	Thru	Peds	Exclu. Total	Inclu. Total	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	1	0	0	0	1	0	0	2	2
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	1	0	0	0	1	0	0	2	2
05:00 PM	0	0	0	2	0	0	0	1	0	0	3	3
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	2	0	0	0	1	0	0	3	3
Grand Total	0	0	0	3	0	0	0	2	0	0	5	5
Apprch %	0	0		100	0		0	100				
Total %	0	0		60	0		0	40		0	100	

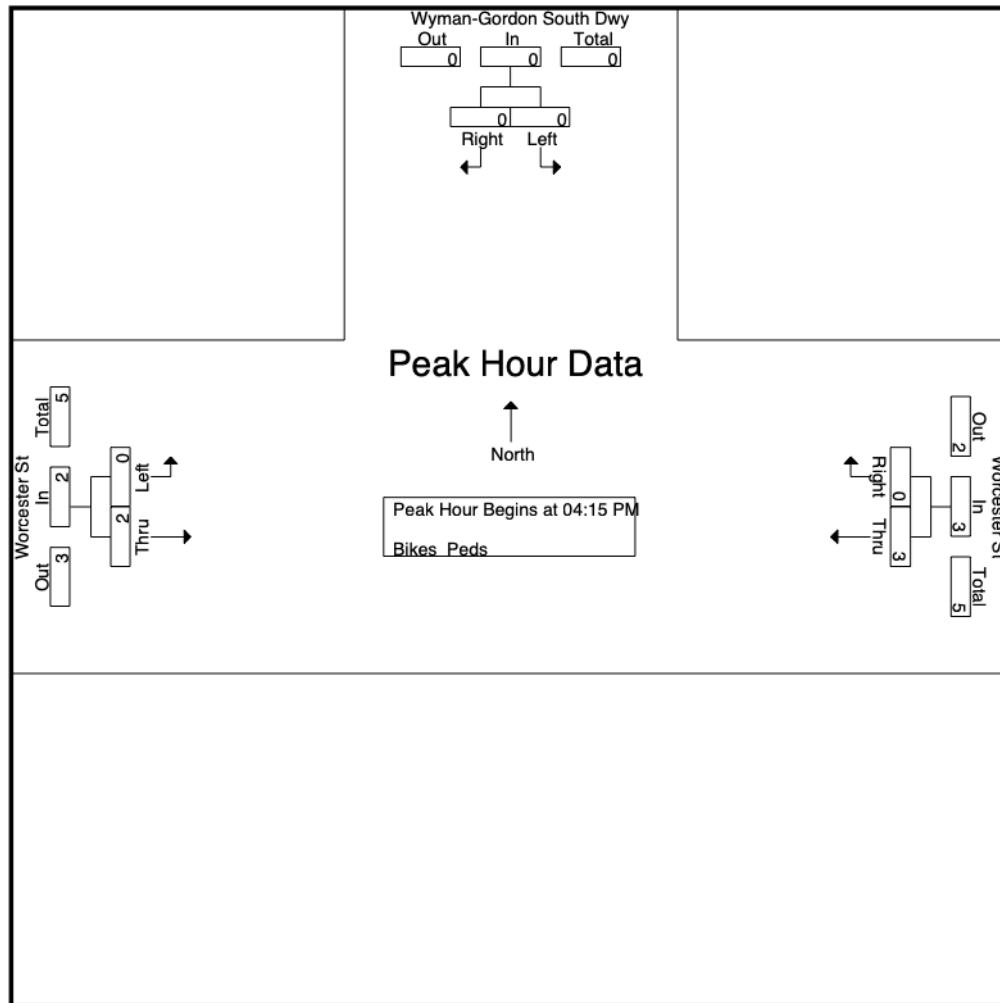
	Wyman-Gordon South Dwy From North			Worcester St From East			Worcester St From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:15 PM										
04:15 PM	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	1	0	1	0	1	1	2
04:45 PM	0	0	0	0	0	0	0	0	0	0
05:00 PM	0	0	0	2	0	2	0	1	1	3
Total Volume	0	0	0	3	0	3	0	2	2	5
% App. Total	0	0		100	0		0	100		
PHF	.000	.000	.000	.375	.000	.375	.000	.500	.500	.417

# Accurate Counts

978-664-2565

N/S Street : Wyman-Gordon South Dwy  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 11



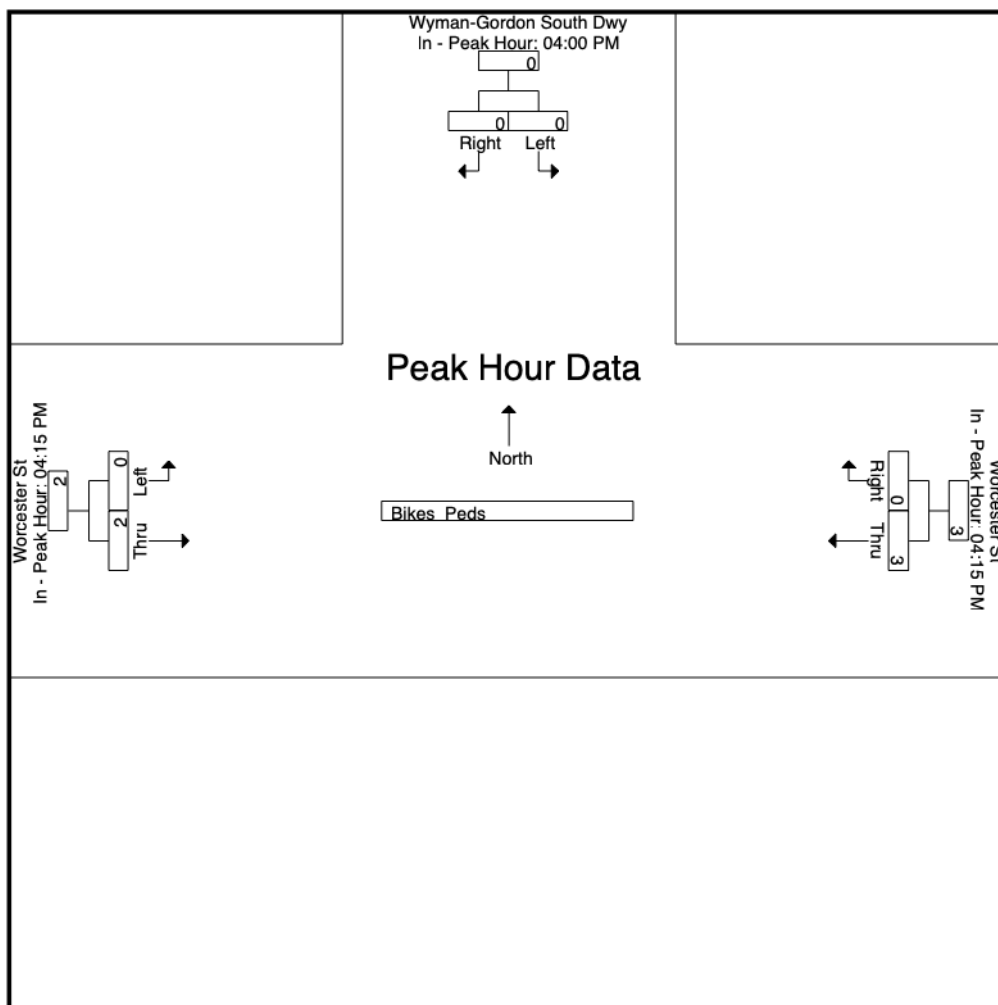
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	04:00 PM			04:15 PM			04:15 PM		
+0 mins.	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	1	0	1	0	1	1
+30 mins.	0	0	0	0	0	0	0	0	0
+45 mins.	0	0	0	2	0	2	0	1	1
Total Volume	0	0	0	3	0	3	0	2	2
% App. Total	0	0		100	0		0	100	
PHF	.000	.000	.000	.375	.000	.375	.000	.500	.500

## 978-664-2565

File Name : 89150001  
Site Code : 89150001  
Start Date : 3/23/2021  
Page No : 12



# Accurate Counts

978-664-2565

N/S Street : North Dwy / Brigham Hill Rd  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 1

## Groups Printed- Cars - Trucks

	Wyman Gordon North Dwy From North			Worcester St From East			Brigham Hill Rd From South			Worcester St From West			Int. Total
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:00 AM	0	0	1	0	91	0	22	0	0	2	97	6	219
07:15 AM	2	0	1	0	113	2	34	1	1	2	86	7	249
07:30 AM	0	0	0	2	110	4	36	1	1	5	100	13	272
07:45 AM	0	0	1	2	82	1	36	0	0	3	109	11	245
Total	2	0	3	4	396	7	128	2	2	12	392	37	985
08:00 AM	0	0	0	1	102	1	23	0	3	4	100	12	246
08:15 AM	0	0	0	0	109	1	25	1	0	4	83	8	231
08:30 AM	0	0	1	0	83	1	16	1	1	1	83	15	202
08:45 AM	0	0	0	1	99	1	12	0	0	3	102	16	234
Total	0	0	1	2	393	4	76	2	4	12	368	51	913
Grand Total	2	0	4	6	789	11	204	4	6	24	760	88	1898
Apprch %	33.3	0	66.7	0.7	97.9	1.4	95.3	1.9	2.8	2.8	87.2	10.1	
Total %	0.1	0	0.2	0.3	41.6	0.6	10.7	0.2	0.3	1.3	40	4.6	
Cars	1	0	2	6	758	10	203	4	6	20	737	83	1830
% Cars	50	0	50	100	96.1	90.9	99.5	100	100	83.3	97	94.3	96.4
Trucks	1	0	2	0	31	1	1	0	0	4	23	5	68
% Trucks	50	0	50	0	3.9	9.1	0.5	0	0	16.7	3	5.7	3.6

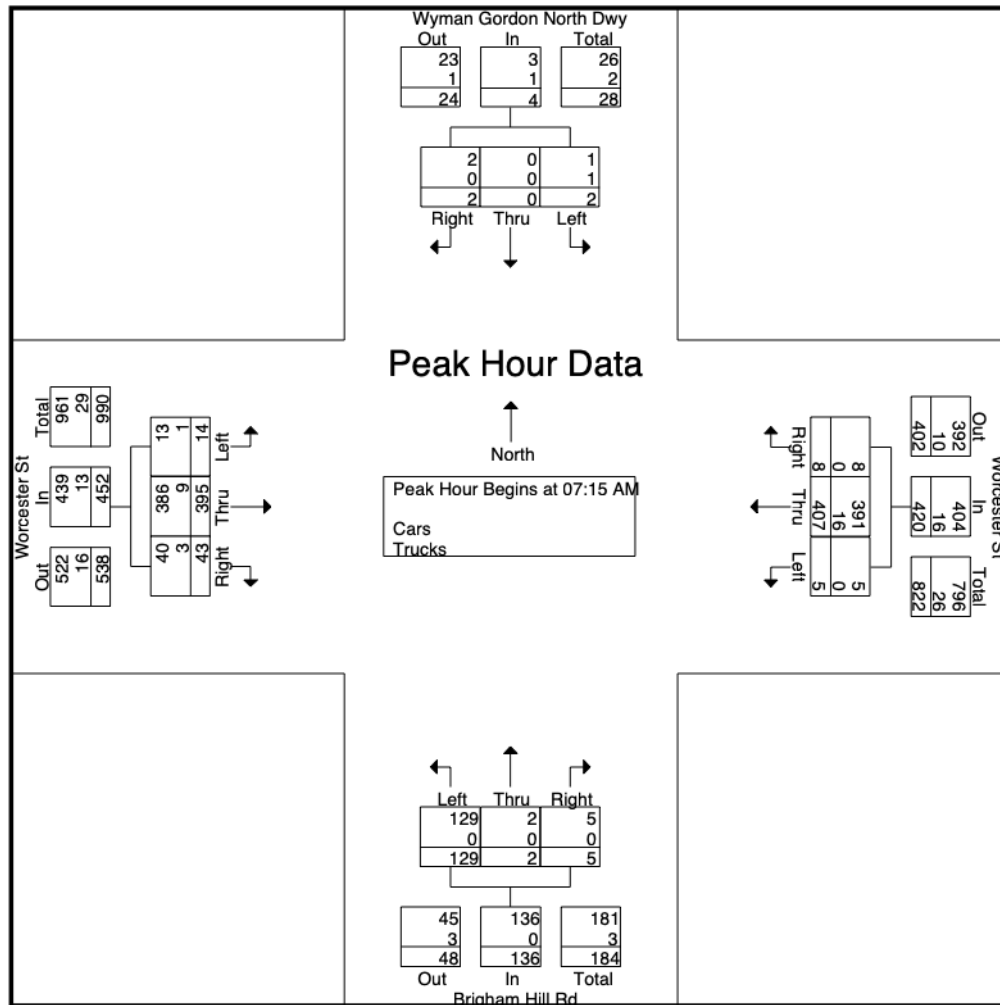
	Wyman Gordon North Dwy From North				Worcester St From East				Brigham Hill Rd From South				Worcester St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	2	0	1	3	0	113	2	115	34	1	1	36	2	86	7	95	249
07:30 AM	0	0	0	0	2	110	4	116	36	1	1	38	5	100	13	118	272
07:45 AM	0	0	1	1	2	82	1	85	36	0	0	36	3	109	11	123	245
08:00 AM	0	0	0	0	1	102	1	104	23	0	3	26	4	100	12	116	246
Total Volume	2	0	2	4	5	407	8	420	129	2	5	136	14	395	43	452	1012
% App. Total	50	0	50		1.2	96.9	1.9		94.9	1.5	3.7		3.1	87.4	9.5		
PHF	.250	.000	.500	.333	.625	.900	.500	.905	.896	.500	.417	.895	.700	.906	.827	.919	.930
Cars	1	0	2	3	5	391	8	404	129	2	5	136	13	386	40	439	982
% Cars	50.0	0	100	75.0	100	96.1	100	96.2	100	100	100	100	92.9	97.7	93.0	97.1	97.0
Trucks	1	0	0	1	0	16	0	16	0	0	0	0	1	9	3	13	30
% Trucks	50.0	0	0	25.0	0	3.9	0	3.8	0	0	0	0	7.1	2.3	7.0	2.9	3.0

# Accurate Counts

978-664-2565

N/S Street : North Dwy / Brigham Hill Rd  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1  
Peak Hour for Each Approach Begins at:

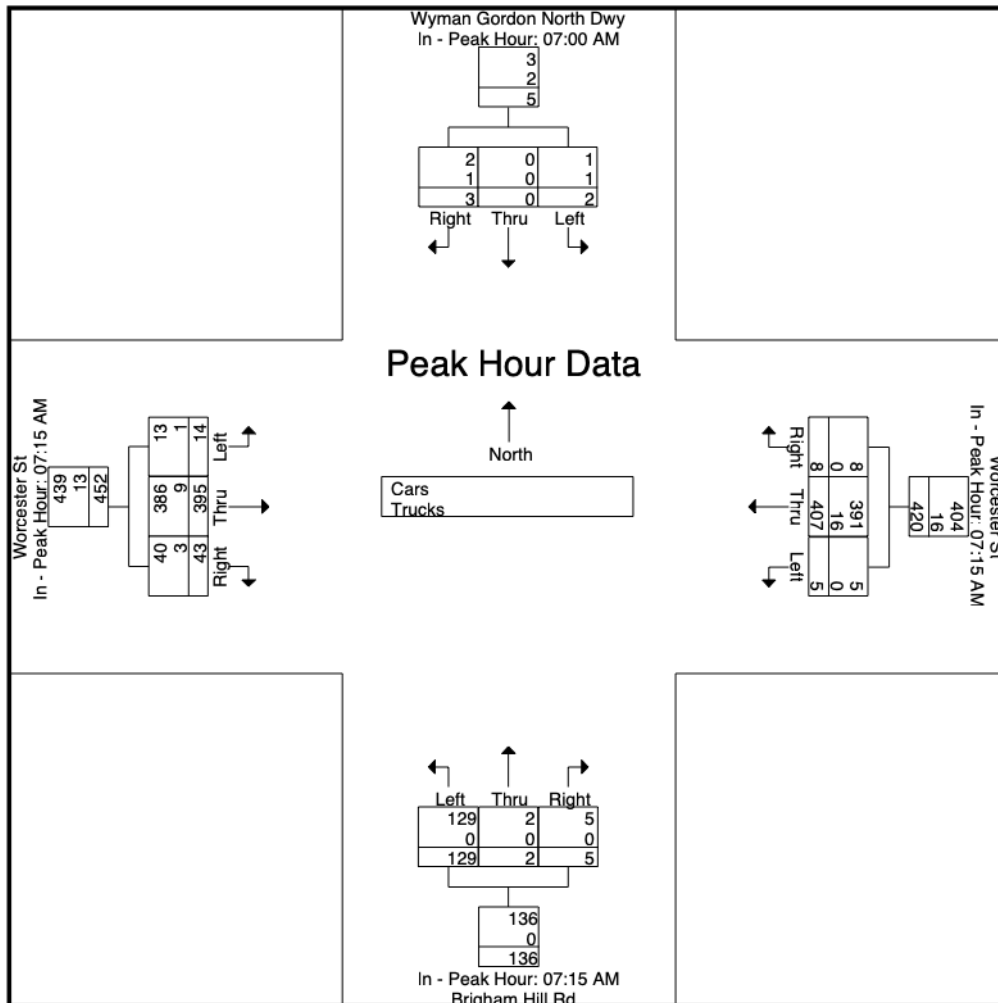
	07:00 AM				07:15 AM				07:15 AM				07:15 AM			
+0 mins.	0	0	1	1	0	113	2	115	34	1	1	36	2	86	7	95
+15 mins.	2	0	1	3	2	110	4	116	36	1	1	38	5	100	13	118
+30 mins.	0	0	0	0	2	82	1	85	36	0	0	36	3	109	11	123
+45 mins.	0	0	1	1	1	102	1	104	23	0	3	26	4	100	12	116
Total Volume	2	0	3	5	5	407	8	420	129	2	5	136	14	395	43	452
% App. Total	40	0	60		1.2	96.9	1.9		94.9	1.5	3.7		3.1	87.4	9.5	
PHF	.250	.000	.750	.417	.625	.900	.500	.905	.896	.500	.417	.895	.700	.906	.827	.919
Cars	1	0	2	3	5	391	8	404	129	2	5	136	13	386	40	439
% Cars	50	0	66.7	60	100	96.1	100	96.2	100	100	100	100	92.9	97.7	93	97.1
Trucks	1	0	1	2	0	16	0	16	0	0	0	0	1	9	3	13
% Trucks	50	0	33.3	40	0	3.9	0	3.8	0	0	0	0	7.1	2.3	7	2.9

# Accurate Counts

978-664-2565

File Name : 89150002  
 Site Code : 89150002  
 Start Date : 3/23/2021  
 Page No : 3

N/S Street : North Dwy / Brigham Hill Rd  
 E/W Street : Worcester Street  
 City/State : North Grafton, MA  
 Weather : Clear



# Accurate Counts

978-664-2565

N/S Street : North Dwy / Brigham Hill Rd  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 4

## Groups Printed- Cars

	Wyman Gordon North Dwy From North			Worcester St From East			Brigham Hill Rd From South			Worcester St From West			Int. Total
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:00 AM	0	0	0	0	89	0	22	0	0	0	94	6	211
07:15 AM	1	0	1	0	109	2	34	1	1	2	86	6	243
07:30 AM	0	0	0	2	105	4	36	1	1	5	99	12	265
07:45 AM	0	0	1	2	82	1	36	0	0	3	105	10	240
Total	1	0	2	4	385	7	128	2	2	10	384	34	959
08:00 AM	0	0	0	1	95	1	23	0	3	3	96	12	234
08:15 AM	0	0	0	0	103	1	25	1	0	3	81	7	221
08:30 AM	0	0	0	0	79	1	15	1	1	1	79	14	191
08:45 AM	0	0	0	1	96	0	12	0	0	3	97	16	225
Total	0	0	0	2	373	3	75	2	4	10	353	49	871
Grand Total	1	0	2	6	758	10	203	4	6	20	737	83	1830
Apprch %	33.3	0	66.7	0.8	97.9	1.3	95.3	1.9	2.8	2.4	87.7	9.9	
Total %	0.1	0	0.1	0.3	41.4	0.5	11.1	0.2	0.3	1.1	40.3	4.5	

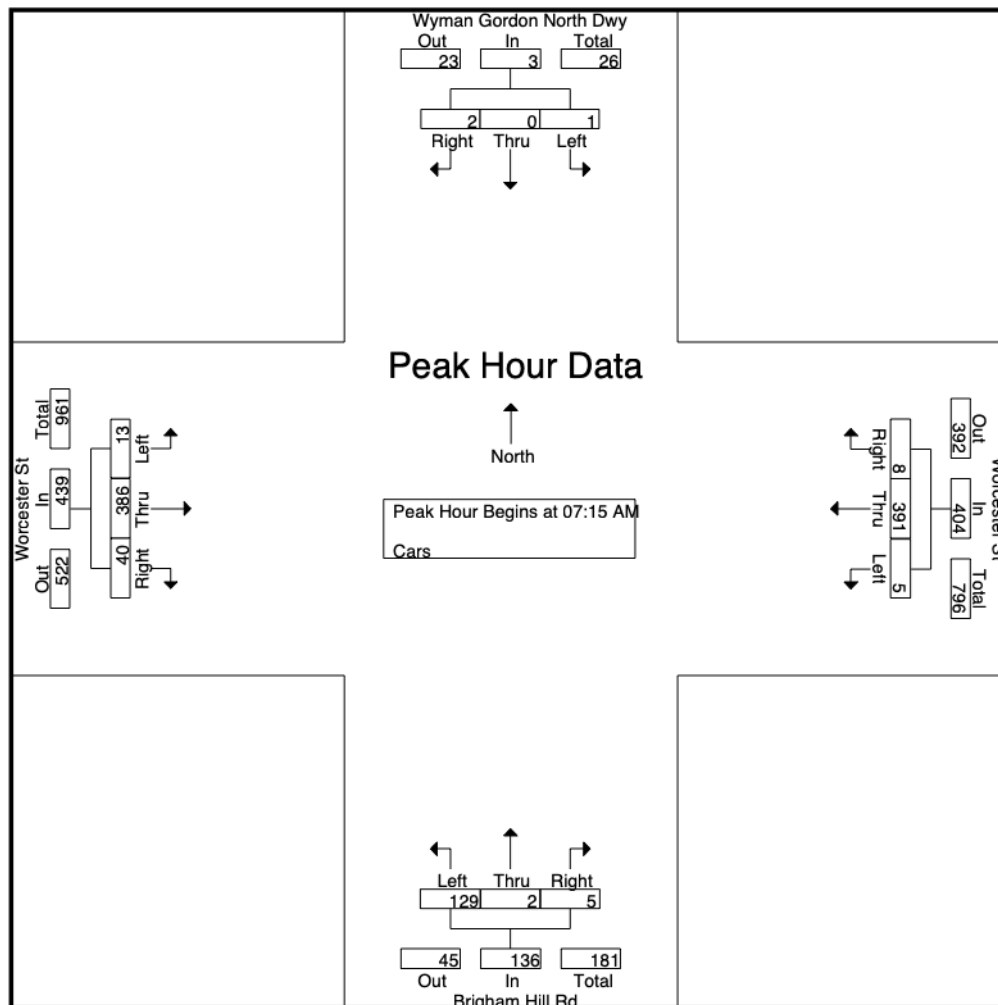
	Wyman Gordon North Dwy From North				Worcester St From East				Brigham Hill Rd From South				Worcester St From West				Int. Total
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	1	0	1	2	0	109	2	111	34	1	1	36	2	86	6	94	243
07:30 AM	0	0	0	0	2	105	4	111	36	1	1	38	5	99	12	116	265
07:45 AM	0	0	1	1	2	82	1	85	36	0	0	36	3	105	10	118	240
08:00 AM	0	0	0	0	1	95	1	97	23	0	3	26	3	96	12	111	234
Total Volume	1	0	2	3	5	391	8	404	129	2	5	136	13	386	40	439	982
% App. Total	33.3	0	66.7		1.2	96.8	2		94.9	1.5	3.7		3	87.9	9.1		
PHF	.250	.000	.500	.375	.625	.897	.500	.910	.896	.500	.417	.895	.650	.919	.833	.930	.926

# Accurate Counts

978-664-2565

N/S Street : North Dwy / Brigham Hill Rd  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 5



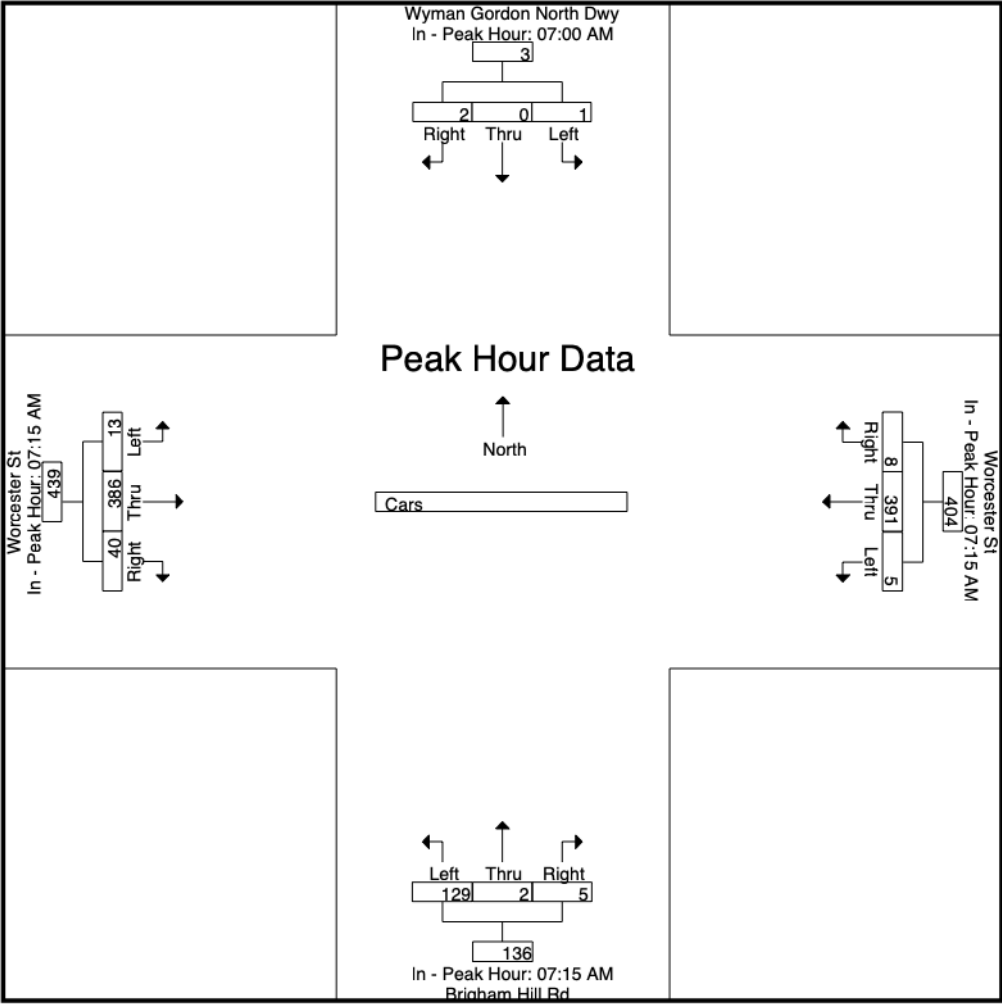
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	07:00 AM				07:15 AM				07:15 AM				07:15 AM			
+0 mins.	0	0	0	0	0	109	2	111	34	1	1	36	2	86	6	94
+15 mins.	1	0	1	2	2	105	4	111	36	1	1	38	5	99	12	116
+30 mins.	0	0	0	0	2	82	1	85	36	0	0	36	3	105	10	118
+45 mins.	0	0	1	1	1	95	1	97	23	0	3	26	3	96	12	111
Total Volume	1	0	2	3	5	391	8	404	129	2	5	136	13	386	40	439
% App. Total	33.3	0	66.7		1.2	96.8	2		94.9	1.5	3.7		3	87.9	9.1	
PHF	.250	.000	.500	.375	.625	.897	.500	.910	.896	.500	.417	.895	.650	.919	.833	.930

N/S Street : North Dwy / Brigham Hill Rd  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 6



# Accurate Counts

978-664-2565

N/S Street : North Dwy / Brigham Hill Rd  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 7

## Groups Printed- Trucks

	Wyman Gordon North Dwy From North			Worcester St From East			Brigham Hill Rd From South			Worcester St From West			Int. Total
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:00 AM	0	0	1	0	2	0	0	0	0	2	3	0	8
07:15 AM	1	0	0	0	4	0	0	0	0	0	0	1	6
07:30 AM	0	0	0	0	5	0	0	0	0	0	1	1	7
07:45 AM	0	0	0	0	0	0	0	0	0	0	4	1	5
Total	1	0	1	0	11	0	0	0	0	2	8	3	26
08:00 AM	0	0	0	0	7	0	0	0	0	1	4	0	12
08:15 AM	0	0	0	0	6	0	0	0	0	1	2	1	10
08:30 AM	0	0	1	0	4	0	1	0	0	0	4	1	11
08:45 AM	0	0	0	0	3	1	0	0	0	0	5	0	9
Total	0	0	1	0	20	1	1	0	0	2	15	2	42
Grand Total	1	0	2	0	31	1	1	0	0	4	23	5	68
Apprch %	33.3	0	66.7	0	96.9	3.1	100	0	0	12.5	71.9	15.6	
Total %	1.5	0	2.9	0	45.6	1.5	1.5	0	0	5.9	33.8	7.4	

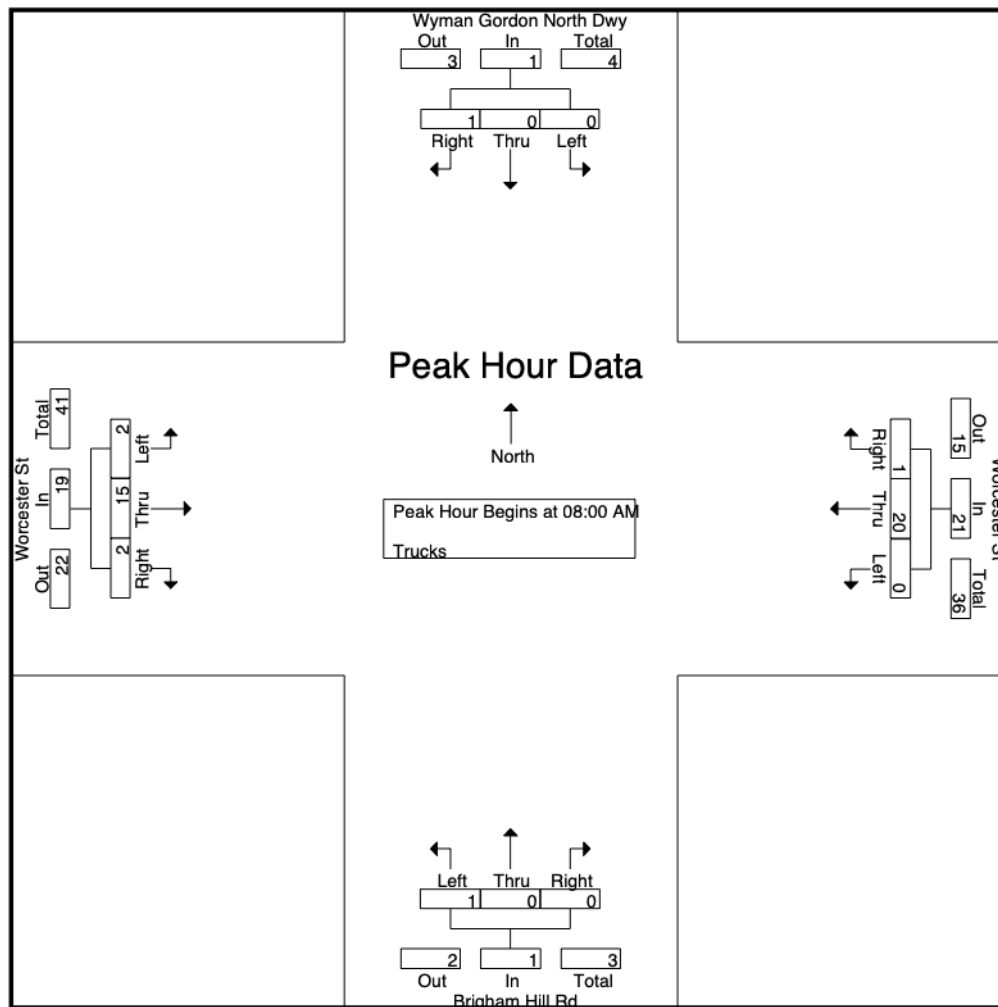
	Wyman Gordon North Dwy From North				Worcester St From East				Brigham Hill Rd From South				Worcester St From West				Int. Total
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	0	0	0	0	0	7	0	7	0	0	0	0	1	4	0	5	12
08:15 AM	0	0	0	0	0	6	0	6	0	0	0	0	1	2	1	4	10
08:30 AM	0	0	1	1	0	4	0	4	1	0	0	1	0	4	1	5	11
08:45 AM	0	0	0	0	0	3	1	4	0	0	0	0	0	5	0	5	9
Total Volume	0	0	1	1	0	20	1	21	1	0	0	1	2	15	2	19	42
% App. Total	0	0	100		0	95.2	4.8		100	0	0		10.5	78.9	10.5		
PHF	.000	.000	.250	.250	.000	.714	.250	.750	.250	.000	.000	.250	.500	.750	.500	.950	.875

# Accurate Counts

978-664-2565

N/S Street : North Dwy / Brigham Hill Rd  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 8

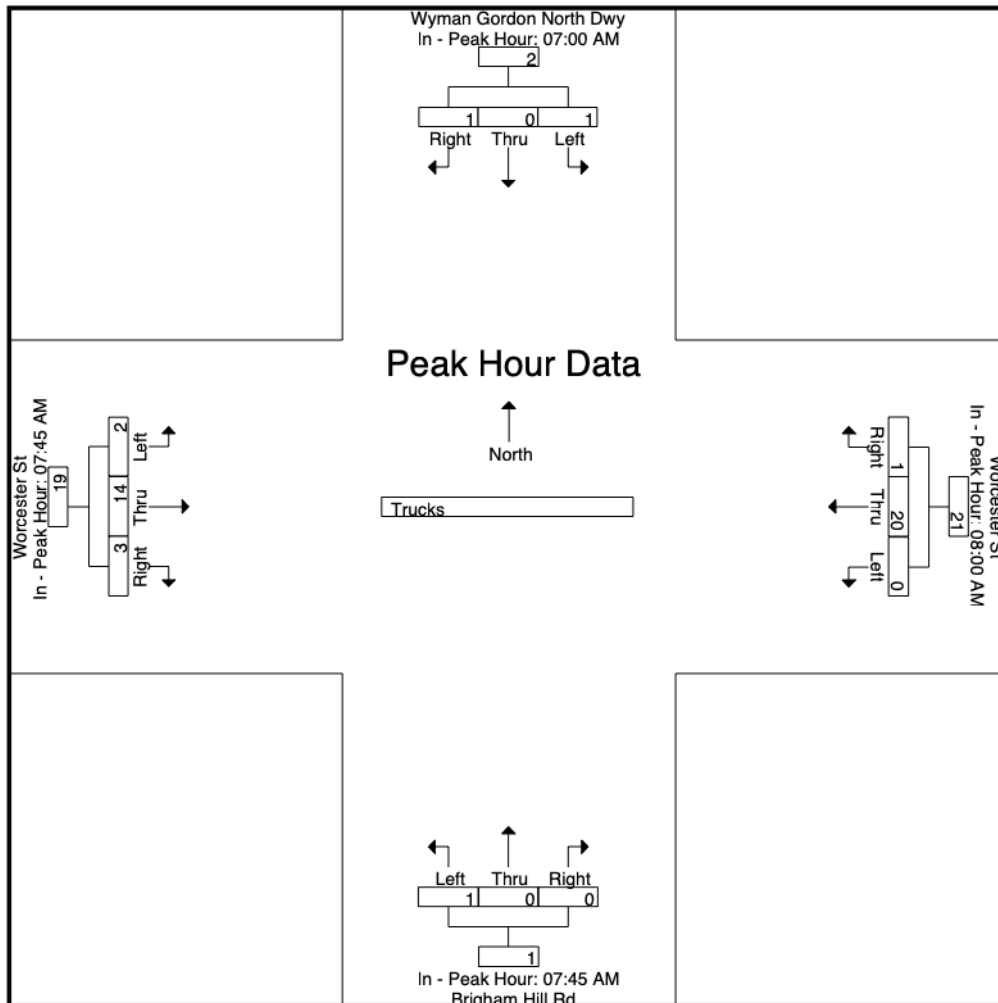


Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	07:00 AM				08:00 AM				07:45 AM				07:45 AM			
+0 mins.	0	0	1	1	0	7	0	7	0	0	0	0	0	4	1	5
+15 mins.	1	0	0	1	0	6	0	6	0	0	0	0	1	4	0	5
+30 mins.	0	0	0	0	0	4	0	4	0	0	0	0	1	2	1	4
+45 mins.	0	0	0	0	0	3	1	4	1	0	0	1	0	4	1	5
Total Volume	1	0	1	2	0	20	1	21	1	0	0	1	2	14	3	19
% App. Total	50	0	50		0	95.2	4.8		100	0	0		10.5	73.7	15.8	
PHF	.250	.000	.250	.500	.000	.714	.250	.750	.250	.000	.000	.250	.500	.875	.750	.950

N/S Street : North Dwy / Brigham Hill Rd  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear



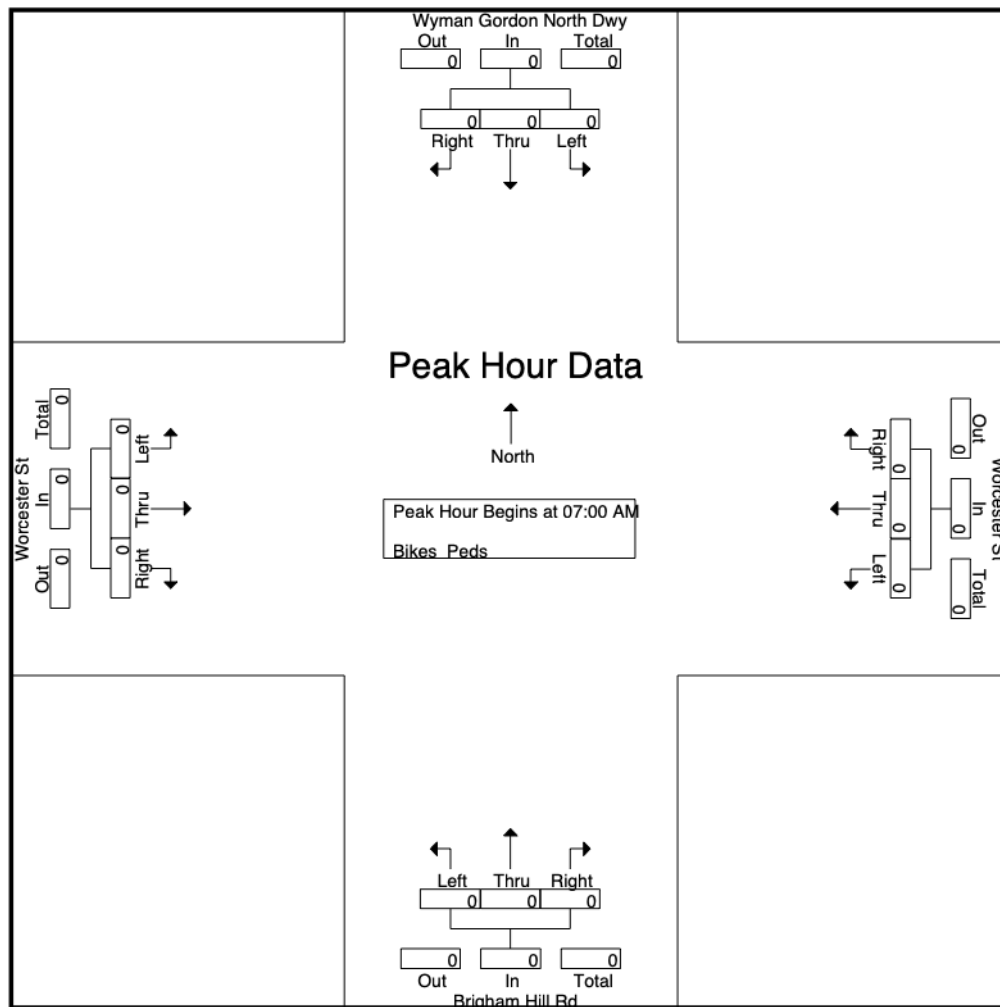
978-664-2565

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 10

[illegible][illegible]

978-664-2565

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 11

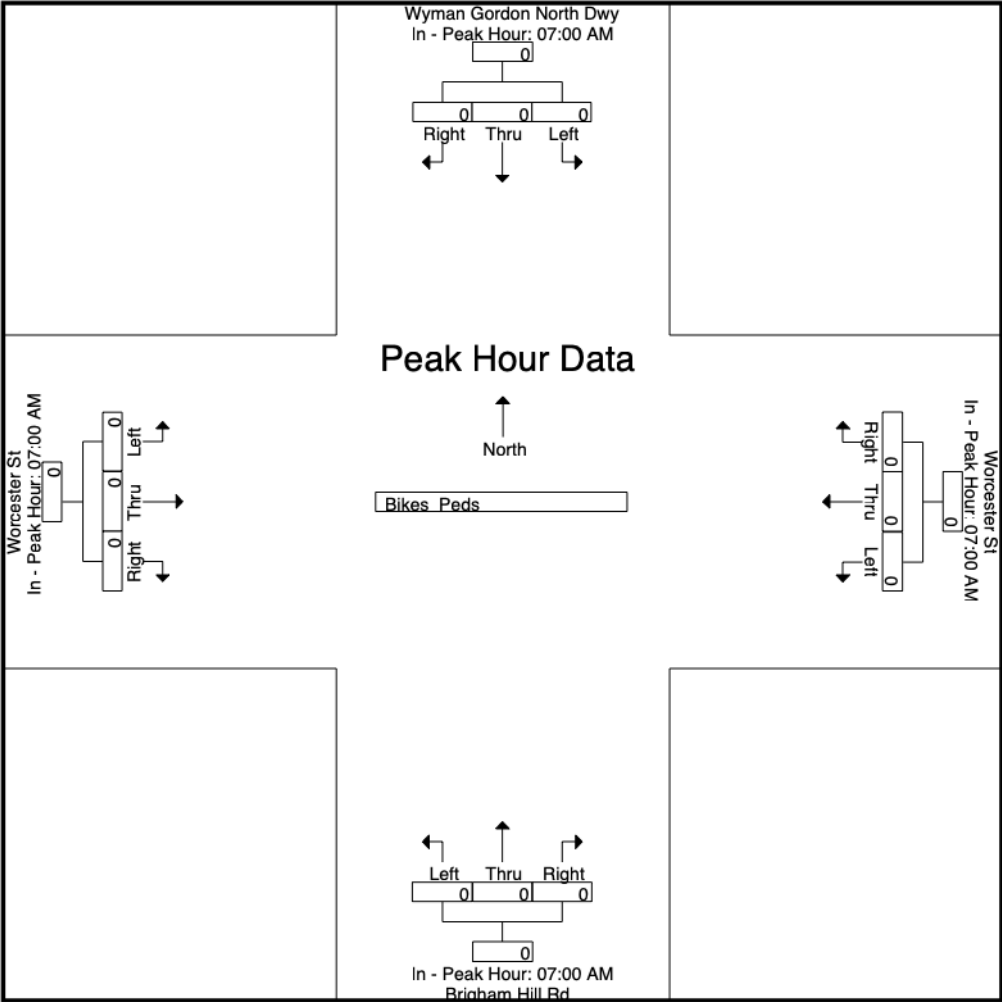


Hourly Fee for Each Approach Begins at:

[illegible]

N/S Street : North Dwy / Brigham Hill Rd  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 12



# Accurate Counts

978-664-2565

N/S Street : North Dwy / Brigham Hill Rd  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 1

## Groups Printed- Cars - Trucks

	Wyman Gordon North Dwy From North			Worcester St From East			Brigham Hill Rd From South			Worcester St From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
04:00 PM	5	2	6	1	141	0	14	1	2	1	126	37	336
04:15 PM	1	0	5	1	145	0	13	0	1	0	129	32	327
04:30 PM	2	0	2	3	110	2	12	0	1	1	156	34	323
04:45 PM	1	0	6	1	123	1	14	1	1	1	156	35	340
Total	9	2	19	6	519	3	53	2	5	3	567	138	1326
05:00 PM	4	0	9	2	120	1	7	0	1	0	127	39	310
05:15 PM	1	3	2	0	139	1	17	0	1	0	128	45	337
05:30 PM	0	0	3	0	109	0	20	0	0	1	110	53	296
05:45 PM	0	1	2	1	112	0	12	2	0	0	116	38	284
Total	5	4	16	3	480	2	56	2	2	1	481	175	1227
Grand Total	14	6	35	9	999	5	109	4	7	4	1048	313	2553
Apprch %	25.5	10.9	63.6	0.9	98.6	0.5	90.8	3.3	5.8	0.3	76.8	22.9	
Total %	0.5	0.2	1.4	0.4	39.1	0.2	4.3	0.2	0.3	0.2	41	12.3	
Cars	14	5	34	9	981	5	109	3	7	4	1037	313	2521
% Cars	100	83.3	97.1	100	98.2	100	100	75	100	100	99	100	98.7
Trucks	0	1	1	0	18	0	0	1	0	0	11	0	32
% Trucks	0	16.7	2.9	0	1.8	0	0	25	0	0	1	0	1.3

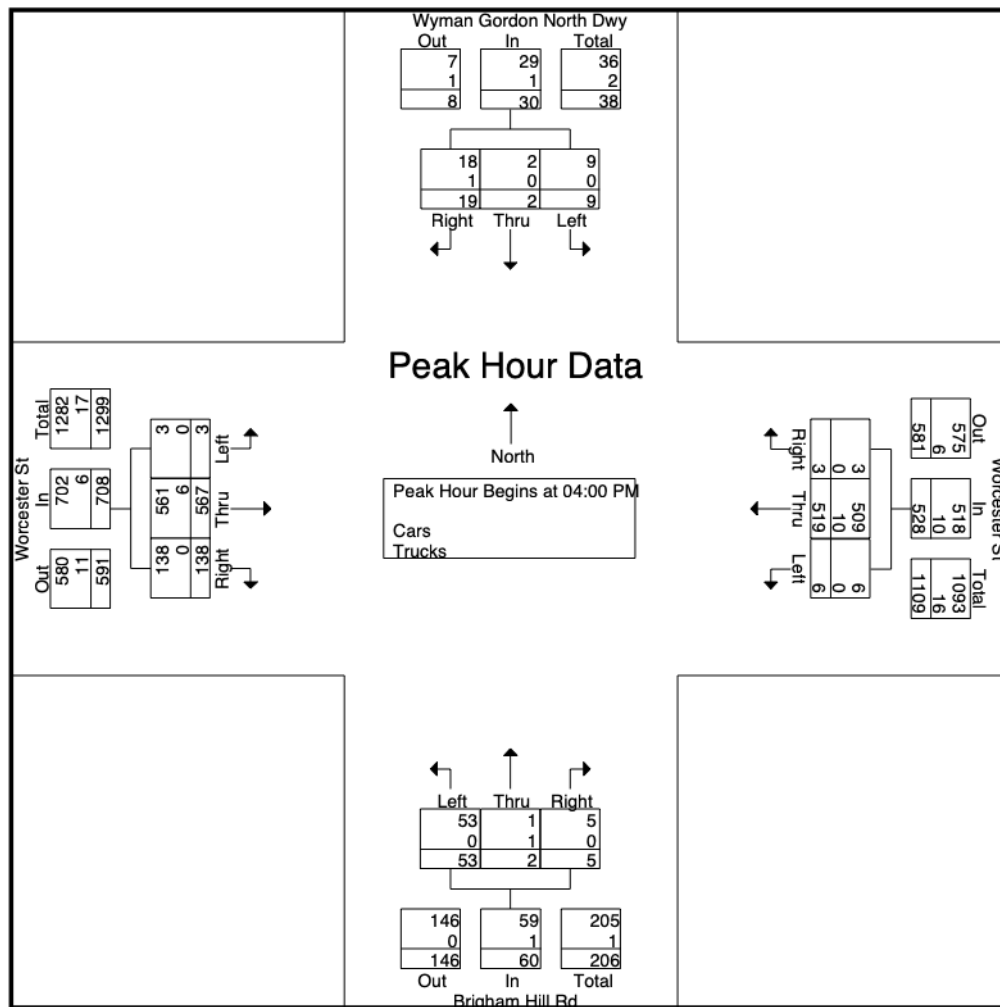
	Wyman Gordon North Dwy From North				Worcester St From East				Brigham Hill Rd From South				Worcester St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	5	2	6	13	1	141	0	142	14	1	2	17	1	126	37	164	336
04:15 PM	1	0	5	6	1	145	0	146	13	0	1	14	0	129	32	161	327
04:30 PM	2	0	2	4	3	110	2	115	12	0	1	13	1	156	34	191	323
04:45 PM	1	0	6	7	1	123	1	125	14	1	1	16	1	156	35	192	340
Total Volume	9	2	19	30	6	519	3	528	53	2	5	60	3	567	138	708	1326
% App. Total	30	6.7	63.3		1.1	98.3	0.6		88.3	3.3	8.3		0.4	80.1	19.5		
PHF	.450	.250	.792	.577	.500	.895	.375	.904	.946	.500	.625	.882	.750	.909	.932	.922	.975
Cars	9	2	18	29	6	509	3	518	53	1	5	59	3	561	138	702	1308
% Cars	100	100	94.7	96.7	100	98.1	100	98.1	100	50.0	100	98.3	100	98.9	100	99.2	98.6
Trucks	0	0	1	1	0	10	0	10	0	1	0	1	0	6	0	6	18
% Trucks	0	0	5.3	3.3	0	1.9	0	1.9	0	50.0	0	1.7	0	1.1	0	0.8	1.4

# Accurate Counts

978-664-2565

N/S Street : North Dwy / Brigham Hill Rd  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

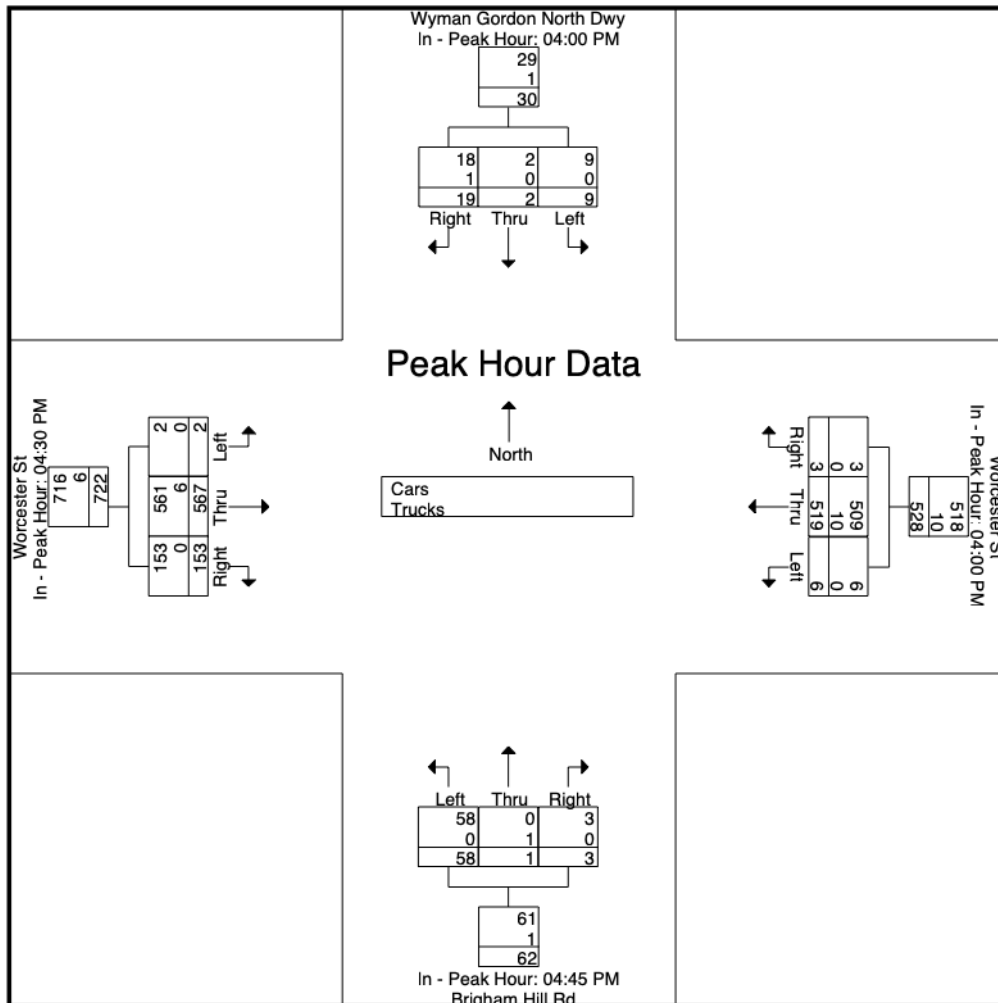
	04:00 PM				04:00 PM				04:45 PM				04:30 PM			
+0 mins.	5	2	6	13	1	141	0	142	14	1	1	16	1	156	34	191
+15 mins.	1	0	5	6	1	145	0	146	7	0	1	8	1	156	35	192
+30 mins.	2	0	2	4	3	110	2	115	17	0	1	18	0	127	39	166
+45 mins.	1	0	6	7	1	123	1	125	20	0	0	20	0	128	45	173
Total Volume	9	2	19	30	6	519	3	528	58	1	3	62	2	567	153	722
% App. Total	30	6.7	63.3		1.1	98.3	0.6		93.5	1.6	4.8		0.3	78.5	21.2	
PHF	.450	.250	.792	.577	.500	.895	.375	.904	.725	.250	.750	.775	.500	.909	.850	.940
Cars	9	2	18	29	6	509	3	518	58	0	3	61	2	561	153	716
% Cars	100	100	94.7	96.7	100	98.1	100	98.1	100	0	100	98.4	100	98.9	100	99.2
Trucks	0	0	1	1	0	10	0	10	0	1	0	1	0	6	0	6
% Trucks	0	0	5.3	3.3	0	1.9	0	1.9	0	100	0	1.6	0	1.1	0	0.8

# Accurate Counts

978-664-2565

N/S Street : North Dwy / Brigham Hill Rd  
 E/W Street : Worcester Street  
 City/State : North Grafton, MA  
 Weather : Clear

File Name : 89150002  
 Site Code : 89150002  
 Start Date : 3/23/2021  
 Page No : 3



# Accurate Counts

978-664-2565

N/S Street : North Dwy / Brigham Hill Rd  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 4

## Groups Printed- Cars

	Wyman Gordon North Dwy From North			Worcester St From East			Brigham Hill Rd From South			Worcester St From West			Int. Total
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
04:00 PM	5	2	6	1	138	0	14	1	2	1	124	37	331
04:15 PM	1	0	5	1	141	0	13	0	1	0	128	32	322
04:30 PM	2	0	2	3	109	2	12	0	1	1	154	34	320
04:45 PM	1	0	5	1	121	1	14	0	1	1	155	35	335
Total	9	2	18	6	509	3	53	1	5	3	561	138	1308
05:00 PM	4	0	9	2	119	1	7	0	1	0	126	39	308
05:15 PM	1	2	2	0	138	1	17	0	1	0	126	45	333
05:30 PM	0	0	3	0	106	0	20	0	0	1	110	53	293
05:45 PM	0	1	2	1	109	0	12	2	0	0	114	38	279
Total	5	3	16	3	472	2	56	2	2	1	476	175	1213
Grand Total	14	5	34	9	981	5	109	3	7	4	1037	313	2521
Apprch %	26.4	9.4	64.2	0.9	98.6	0.5	91.6	2.5	5.9	0.3	76.6	23.1	
Total %	0.6	0.2	1.3	0.4	38.9	0.2	4.3	0.1	0.3	0.2	41.1	12.4	

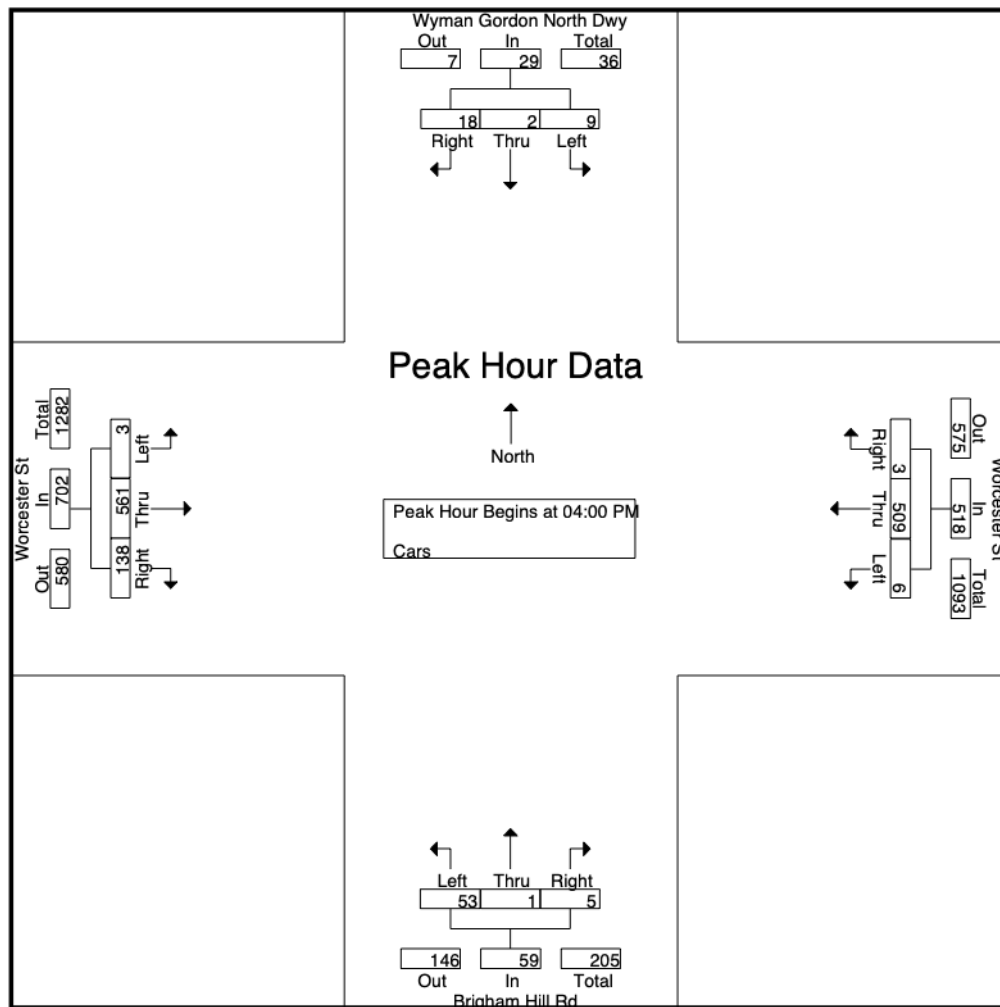
	Wyman Gordon North Dwy From North				Worcester St From East				Brigham Hill Rd From South				Worcester St From West				Int. Total
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	5	2	6	13	1	138	0	139	14	1	2	17	1	124	37	162	331
04:15 PM	1	0	5	6	1	141	0	142	13	0	1	14	0	128	32	160	322
04:30 PM	2	0	2	4	3	109	2	114	12	0	1	13	1	154	34	189	320
04:45 PM	1	0	5	6	1	121	1	123	14	0	1	15	1	155	35	191	335
Total Volume	9	2	18	29	6	509	3	518	53	1	5	59	3	561	138	702	1308
% App. Total	31	6.9	62.1		1.2	98.3	0.6		89.8	1.7	8.5		0.4	79.9	19.7		
PHF	.450	.250	.750	.558	.500	.902	.375	.912	.946	.250	.625	.868	.750	.905	.932	.919	.976

# Accurate Counts

978-664-2565

N/S Street : North Dwy / Brigham Hill Rd  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 5



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1  
Peak Hour for Each Approach Begins at:

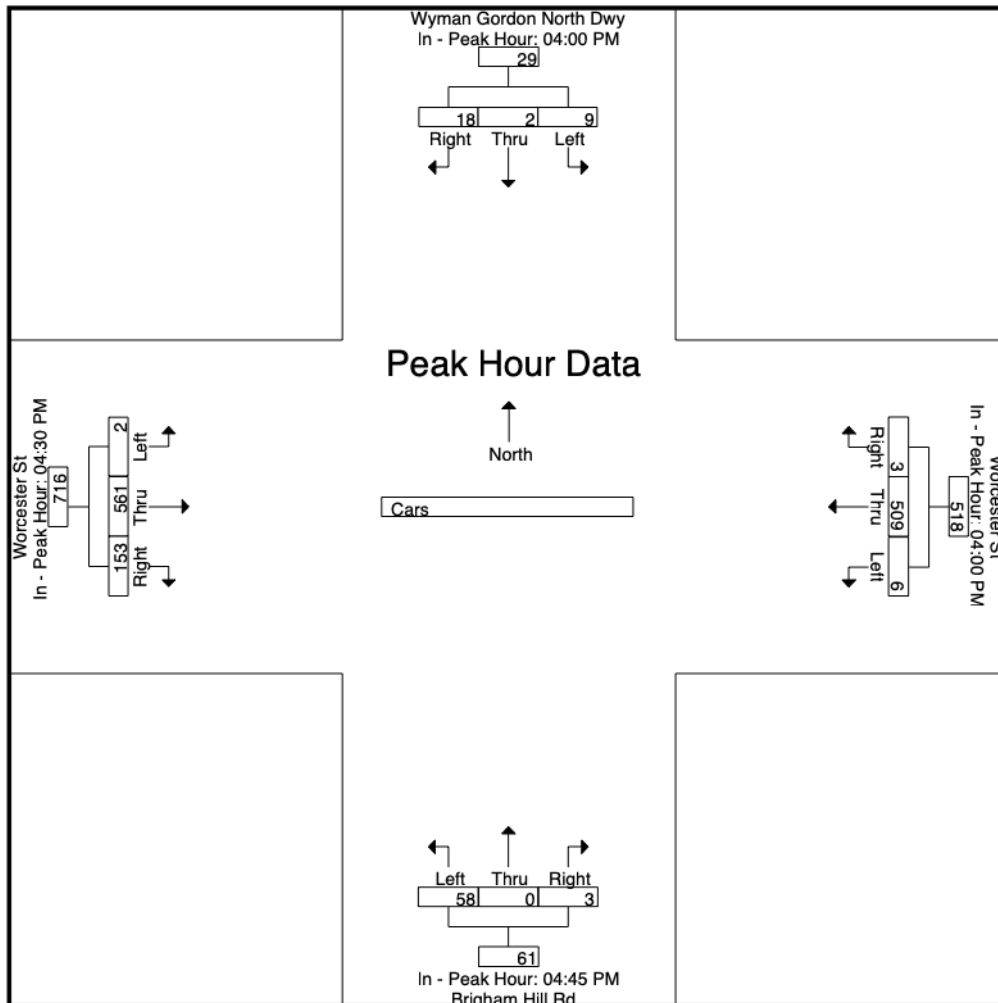
	04:00 PM				04:00 PM				04:45 PM				04:30 PM			
+0 mins.	5	2	6	13	1	138	0	139	14	0	1	15	1	154	34	189
+15 mins.	1	0	5	6	1	141	0	142	7	0	1	8	1	155	35	191
+30 mins.	2	0	2	4	3	109	2	114	17	0	1	18	0	126	39	165
+45 mins.	1	0	5	6	1	121	1	123	20	0	0	20	0	126	45	171
Total Volume	9	2	18	29	6	509	3	518	58	0	3	61	2	561	153	716
% App. Total	31	6.9	62.1		1.2	98.3	0.6		95.1	0	4.9		0.3	78.4	21.4	
PHF	.450	.250	.750	.558	.500	.902	.375	.912	.725	.000	.750	.763	.500	.905	.850	.937

# Accurate Counts

978-664-2565

N/S Street : North Dwy / Brigham Hill Rd  
 E/W Street : Worcester Street  
 City/State : North Grafton, MA  
 Weather : Clear

File Name : 89150002  
 Site Code : 89150002  
 Start Date : 3/23/2021  
 Page No : 6



# Accurate Counts

978-664-2565

N/S Street : North Dwy / Brigham Hill Rd  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 7

## Groups Printed- Trucks

	Wyman Gordon North Dwy From North			Worcester St From East			Brigham Hill Rd From South			Worcester St From West			Int. Total
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
04:00 PM	0	0	0	0	3	0	0	0	0	0	2	0	5
04:15 PM	0	0	0	0	4	0	0	0	0	0	1	0	5
04:30 PM	0	0	0	0	1	0	0	0	0	0	2	0	3
04:45 PM	0	0	1	0	2	0	0	1	0	0	1	0	5
Total	0	0	1	0	10	0	0	1	0	0	6	0	18
05:00 PM	0	0	0	0	1	0	0	0	0	0	1	0	2
05:15 PM	0	1	0	0	1	0	0	0	0	0	2	0	4
05:30 PM	0	0	0	0	3	0	0	0	0	0	0	0	3
05:45 PM	0	0	0	0	3	0	0	0	0	0	2	0	5
Total	0	1	0	0	8	0	0	0	0	0	5	0	14
Grand Total	0	1	1	0	18	0	0	1	0	0	11	0	32
Apprch %	0	50	50	0	100	0	0	100	0	0	100	0	
Total %	0	3.1	3.1	0	56.2	0	0	3.1	0	0	34.4	0	

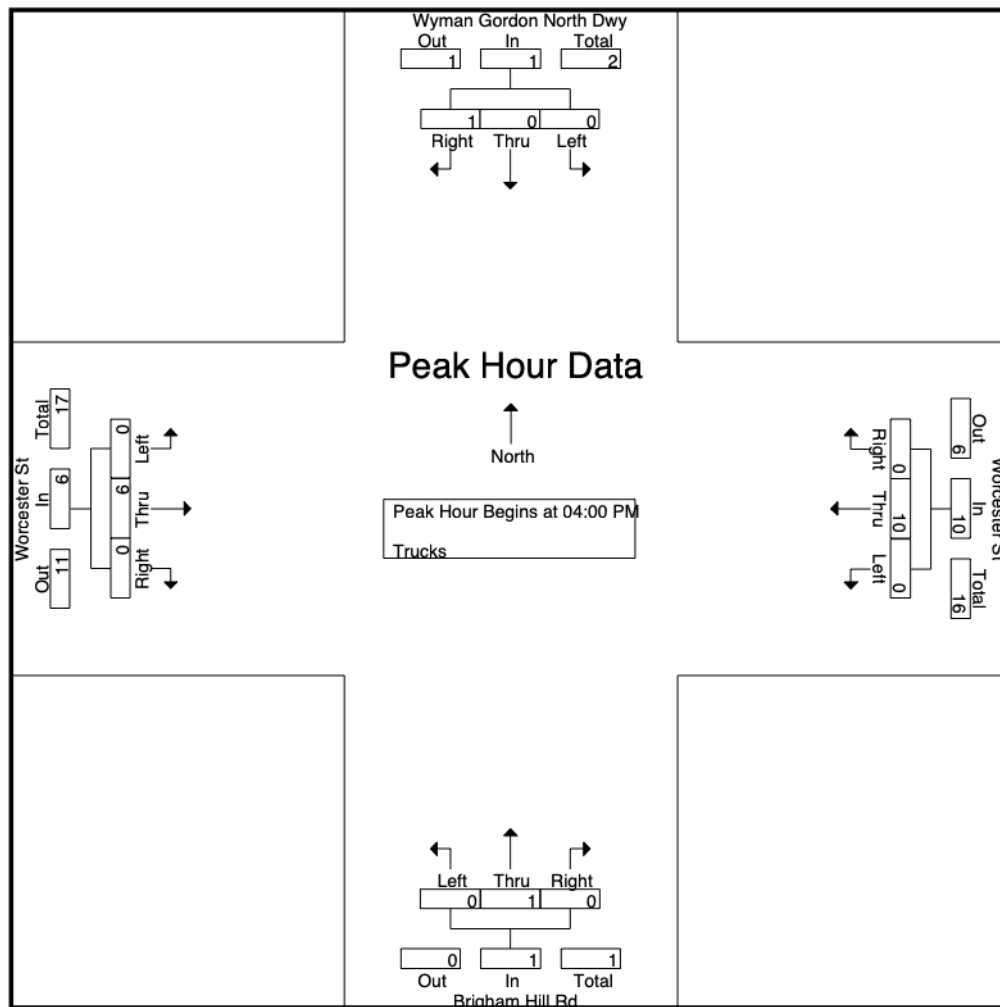
	Wyman Gordon North Dwy From North				Worcester St From East				Brigham Hill Rd From South				Worcester St From West				Int. Total
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	0	0	0	0	0	3	0	3	0	0	0	0	0	2	0	2	5
04:15 PM	0	0	0	0	0	4	0	4	0	0	0	0	0	1	0	1	5
04:30 PM	0	0	0	0	0	1	0	1	0	0	0	0	0	2	0	2	3
04:45 PM	0	0	1	1	0	2	0	2	0	1	0	1	0	1	0	1	5
Total Volume	0	0	1	1	0	10	0	10	0	1	0	1	0	6	0	6	18
% App. Total	0	0	100		0	100	0		0	100	0		0	100	0		
PHF	.000	.000	.250	.250	.000	.625	.000	.625	.000	.250	.000	.250	.000	.750	.000	.750	.900

# Accurate Counts

978-664-2565

N/S Street : North Dwy / Brigham Hill Rd  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 8

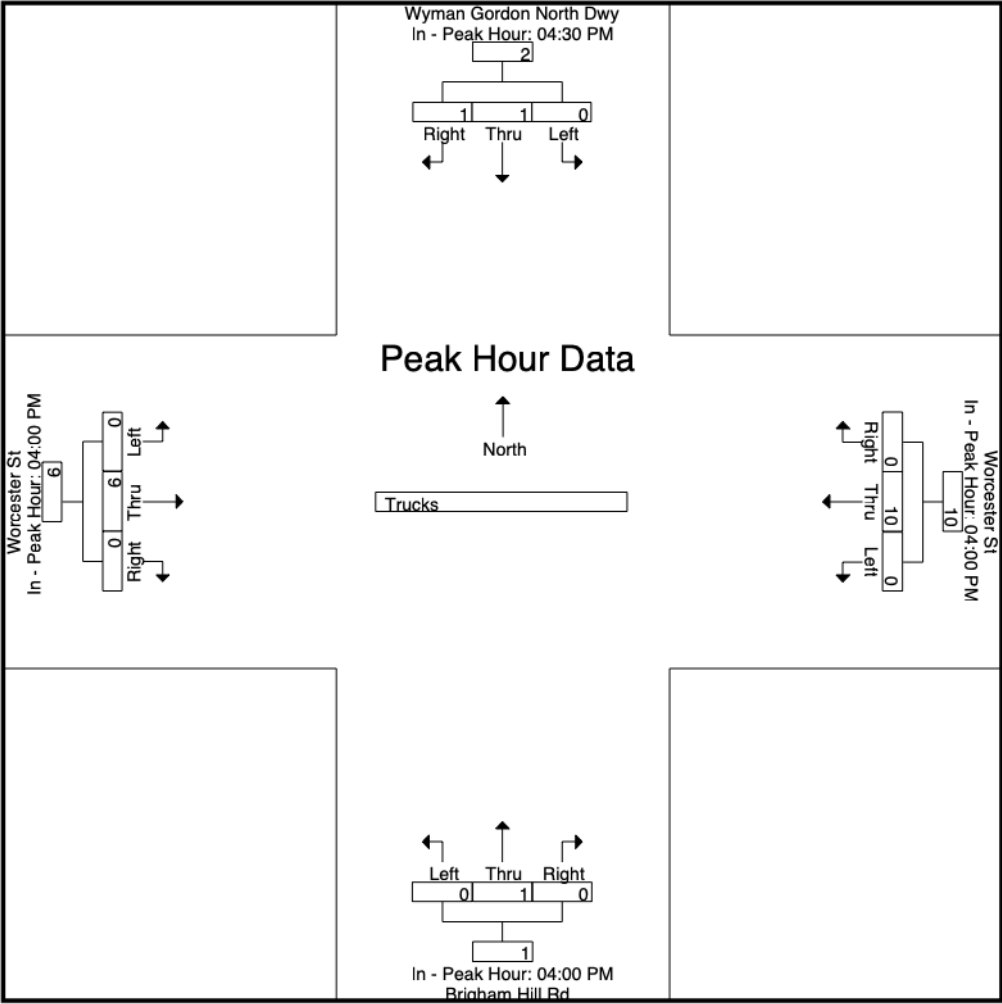


Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1  
Peak Hour for Each Approach Begins at:

	04:30 PM				04:00 PM				04:00 PM				04:00 PM			
+0 mins.	0	0	0	0	0	3	0	3	0	0	0	0	0	2	0	2
+15 mins.	0	0	1	1	0	4	0	4	0	0	0	0	0	1	0	1
+30 mins.	0	0	0	0	0	1	0	1	0	0	0	0	0	2	0	2
+45 mins.	0	1	0	1	0	2	0	2	0	1	0	1	0	1	0	1
Total Volume	0	1	1	2	0	10	0	10	0	1	0	1	0	6	0	6
% App. Total	0	50	50		0	100	0		0	100	0		0	100	0	
PHF	.000	.250	.250	.500	.000	.625	.000	.625	.000	.250	.000	.250	.000	.750	.000	.750

N/S Street : North Dwy / Brigham Hill Rd  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 9



# Accurate Counts

978-664-2565

N/S Street : North Dwy / Brigham Hill Rd  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 10

## Groups Printed- Bikes Peds

	Wyman Gordon North Dwy From North				Worcester St From East				Brigham Hill Rd From South				Worcester St From West				Exclu. Total	Inclu. Total	Int. Total
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds			
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	2	2
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
Total	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	1	3	4
05:00 PM	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	2	2	4
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	2	2	4
Grand Total	0	0	0	0	0	2	0	0	0	0	0	0	0	2	1	0	3	5	8
Apprch %	0	0	0		0	100	0		0	0	0		0	66.7	33.3				
Total %	0	0	0		0	40	0		0	0	0		0	40	20		37.5	62.5	

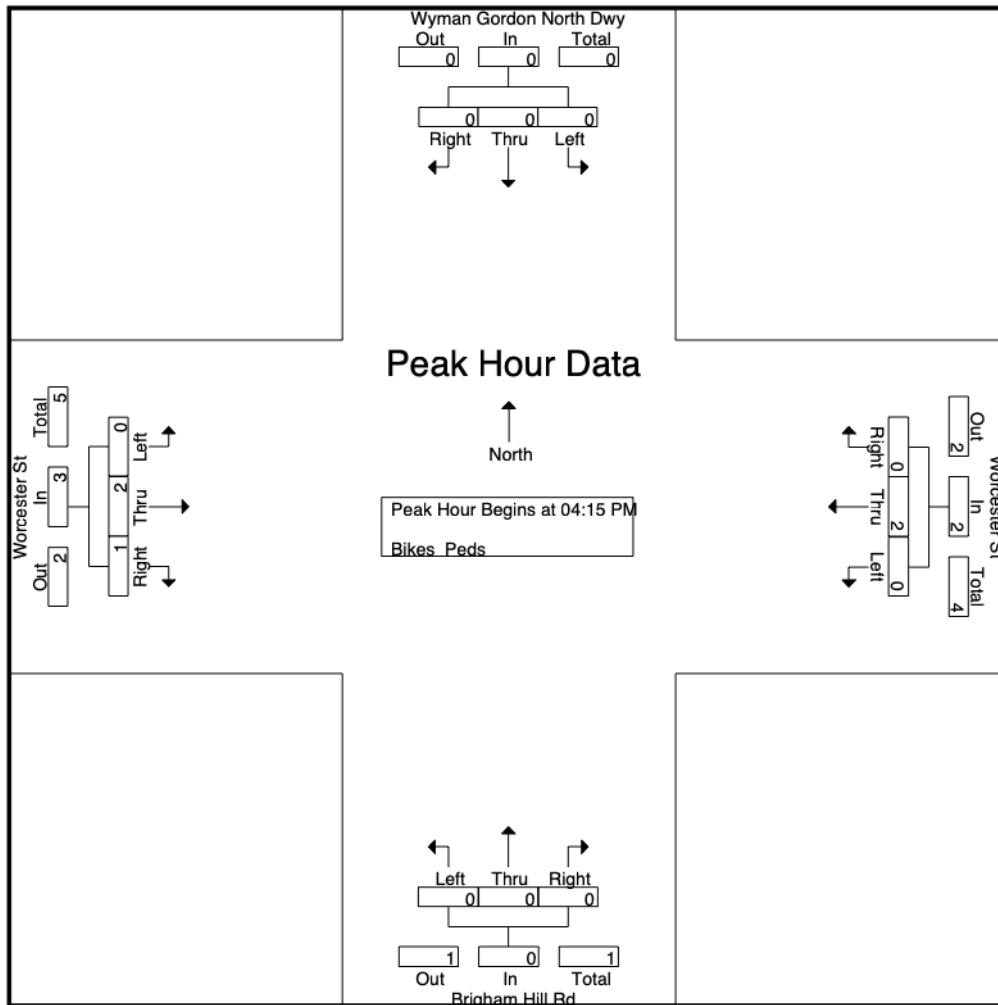
	Wyman Gordon North Dwy From North				Worcester St From East				Brigham Hill Rd From South				Worcester St From West						
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total		
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																			
Peak Hour for Entire Intersection Begins at 04:15 PM																			
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1	1	2	2
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
05:00 PM	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1	2	2	2
Total Volume	0	0	0	0	0	2	0	2	0	0	0	0	0	2	1	3	5	5	5
% App. Total	0	0	0		0	100	0		0	0	0		0	66.7	33.3				
PHF	.000	.000	.000	.000	.000	.500	.000	.500	.000	.000	.000	.000	.000	.500	.250	.750	.625		

# Accurate Counts

978-664-2565

N/S Street : North Dwy / Brigham Hill Rd  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 11

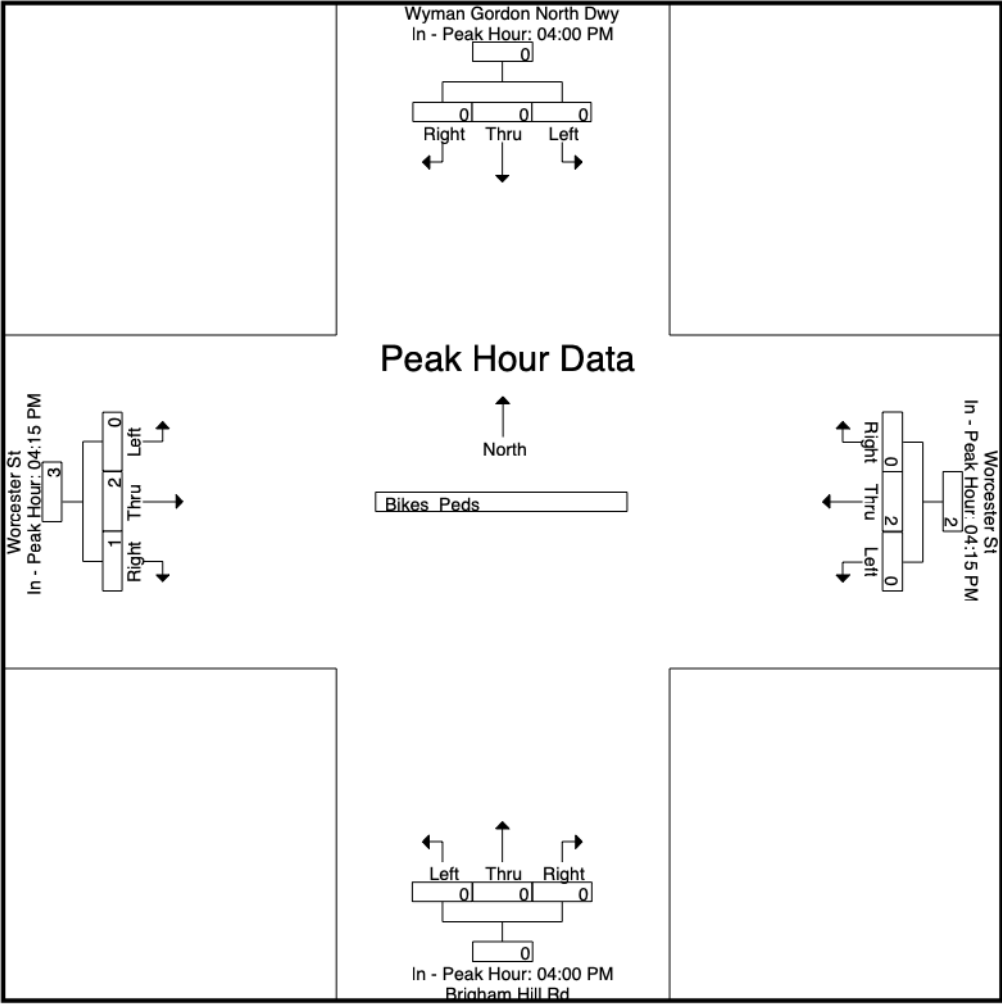


Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1  
Peak Hour for Each Approach Begins at:

	04:00 PM				04:15 PM				04:00 PM				04:15 PM			
+0 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1
+30 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
+45 mins.	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1
Total Volume	0	0	0	0	0	2	0	2	0	0	0	0	0	2	1	3
% App. Total	0	0	0	0	0	100	0	0	0	0	0	0	0	66.7	33.3	0
PHF	.000	.000	.000	.000	.000	.500	.000	.500	.000	.000	.000	.000	.000	.500	.250	.750

N/S Street : North Dwy / Brigham Hill Rd  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150002  
Site Code : 89150002  
Start Date : 3/23/2021  
Page No : 12



# Accurate Counts

978-664-2565

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150003  
Site Code : 89150003  
Start Date : 3/23/2021  
Page No : 1

## Groups Printed- Cars - Trucks

	Worcester St From East		Hilltop St From South		Worcester St From West		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
07:00 AM	0	112	2	2	102	0	218
07:15 AM	0	149	2	0	96	0	247
07:30 AM	0	145	2	0	120	0	267
07:45 AM	0	118	1	1	118	0	238
Total	0	524	7	3	436	0	970
08:00 AM	1	125	1	0	119	0	246
08:15 AM	0	132	0	0	94	0	226
08:30 AM	0	102	1	0	97	1	201
08:45 AM	1	108	0	2	119	0	230
Total	2	467	2	2	429	1	903
Grand Total	2	991	9	5	865	1	1873
Apprch %	0.2	99.8	64.3	35.7	99.9	0.1	
Total %	0.1	52.9	0.5	0.3	46.2	0.1	
Cars	2	955	9	4	834	1	1805
% Cars	100	96.4	100	80	96.4	100	96.4
Trucks	0	36	0	1	31	0	68
% Trucks	0	3.6	0	20	3.6	0	3.6

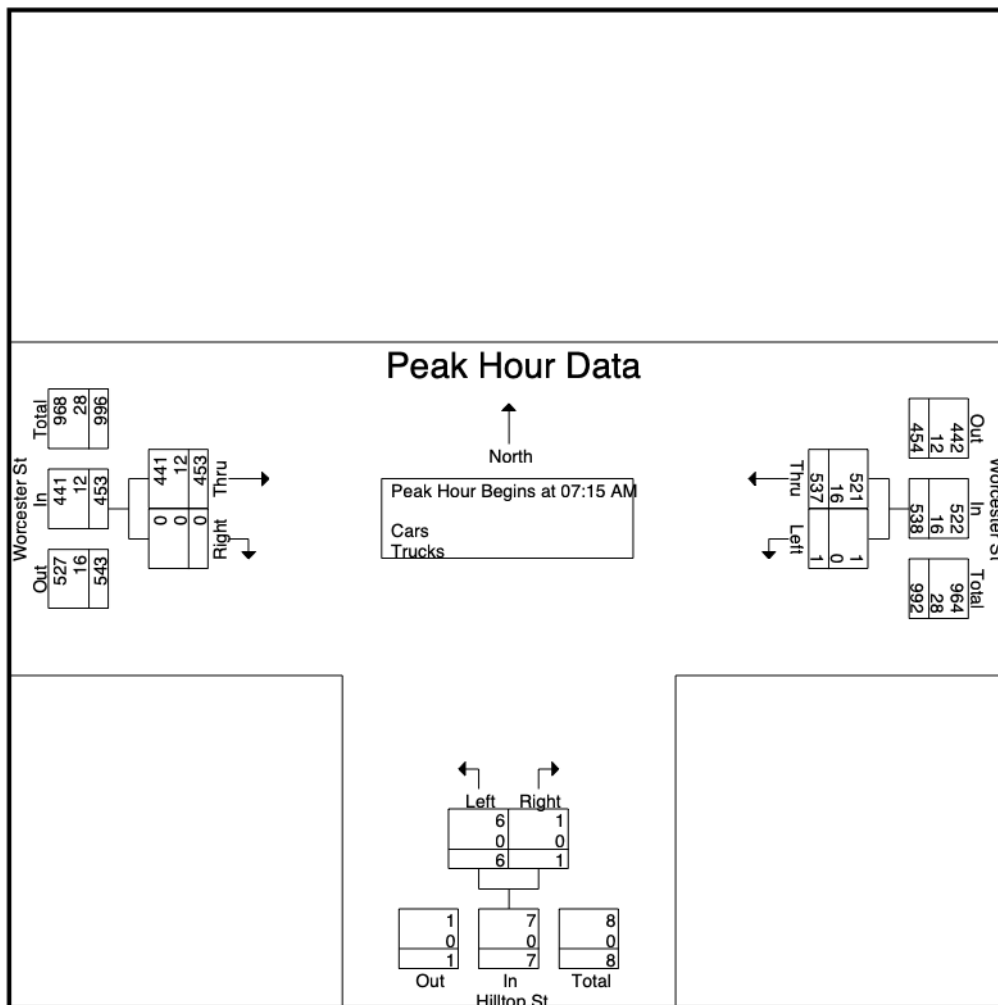
	Worcester St From East			Hilltop St From South			Worcester St From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:15 AM										
07:15 AM	0	149	149	2	0	2	96	0	96	247
07:30 AM	0	145	145	2	0	2	120	0	120	267
07:45 AM	0	118	118	1	1	2	118	0	118	238
08:00 AM	1	125	126	1	0	1	119	0	119	246
Total Volume	1	537	538	6	1	7	453	0	453	998
% App. Total	0.2	99.8		85.7	14.3		100	0		
PHF	.250	.901	.903	.750	.250	.875	.944	.000	.944	.934
Cars	1	521	522	6	1	7	441	0	441	970
% Cars	100	97.0	97.0	100	100	100	97.4	0	97.4	97.2
Trucks	0	16	16	0	0	0	12	0	12	28
% Trucks	0	3.0	3.0	0	0	0	2.6	0	2.6	2.8

# Accurate Counts

978-664-2565

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150003  
Site Code : 89150003  
Start Date : 3/23/2021  
Page No : 2

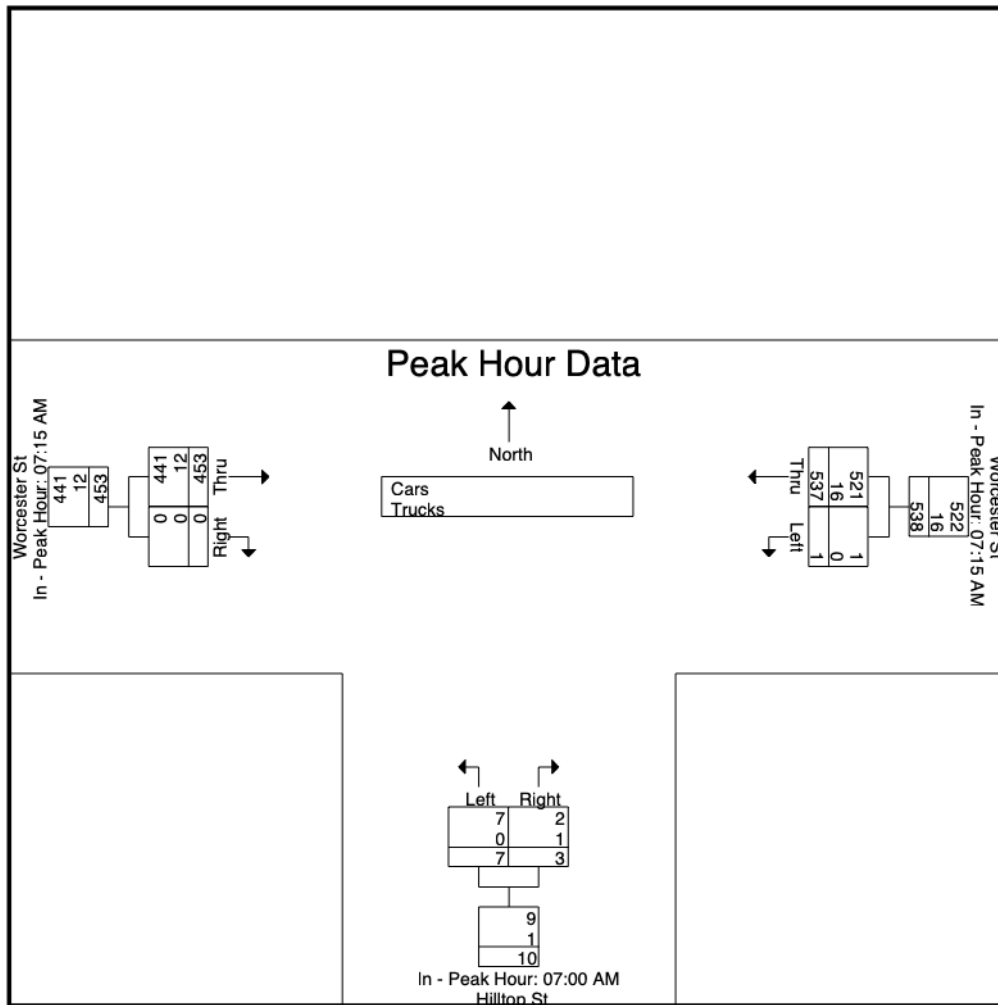


Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	07:15 AM			07:00 AM			07:15 AM		
+0 mins.	0	149	149	2	2	4	96	0	96
+15 mins.	0	145	145	2	0	2	120	0	120
+30 mins.	0	118	118	2	0	2	118	0	118
+45 mins.	1	125	126	1	1	2	119	0	119
Total Volume	1	537	538	7	3	10	453	0	453
% App. Total	0.2	99.8		70	30		100	0	
PHF	.250	.901	.903	.875	.375	.625	.944	.000	.944
Cars	1	521	522	7	2	9	441	0	441
% Cars	100	97	97	100	66.7	90	97.4	0	97.4
Trucks	0	16	16	0	1	1	12	0	12
% Trucks	0	3	3	0	33.3	10	2.6	0	2.6

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear



# Accurate Counts

978-664-2565

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150003  
Site Code : 89150003  
Start Date : 3/23/2021  
Page No : 4

## Groups Printed- Cars

	Worcester St From East		Hilltop St From South		Worcester St From West		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
07:00 AM	0	109	2	1	97	0	209
07:15 AM	0	145	2	0	96	0	243
07:30 AM	0	140	2	0	118	0	260
07:45 AM	0	118	1	1	113	0	233
Total	0	512	7	2	424	0	945
08:00 AM	1	118	1	0	114	0	234
08:15 AM	0	126	0	0	90	0	216
08:30 AM	0	96	1	0	92	1	190
08:45 AM	1	103	0	2	114	0	220
Total	2	443	2	2	410	1	860
Grand Total	2	955	9	4	834	1	1805
Apprch %	0.2	99.8	69.2	30.8	99.9	0.1	
Total %	0.1	52.9	0.5	0.2	46.2	0.1	

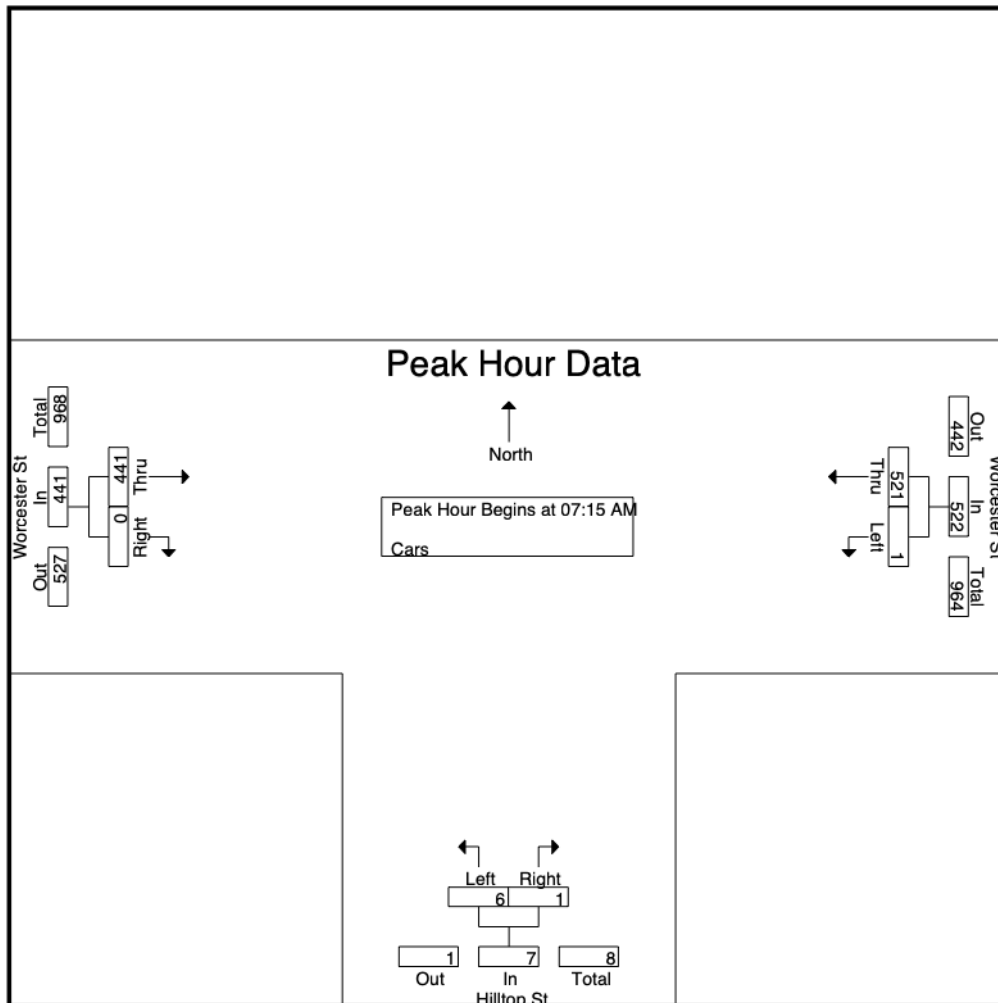
	Worcester St From East			Hilltop St From South			Worcester St From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:15 AM										
07:15 AM	0	145	145	2	0	2	96	0	96	243
07:30 AM	0	140	140	2	0	2	118	0	118	260
07:45 AM	0	118	118	1	1	2	113	0	113	233
08:00 AM	1	118	119	1	0	1	114	0	114	234
Total Volume	1	521	522	6	1	7	441	0	441	970
% App. Total	0.2	99.8		85.7	14.3		100	0		
PHF	.250	.898	.900	.750	.250	.875	.934	.000	.934	.933

# Accurate Counts

978-664-2565

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150003  
Site Code : 89150003  
Start Date : 3/23/2021  
Page No : 5



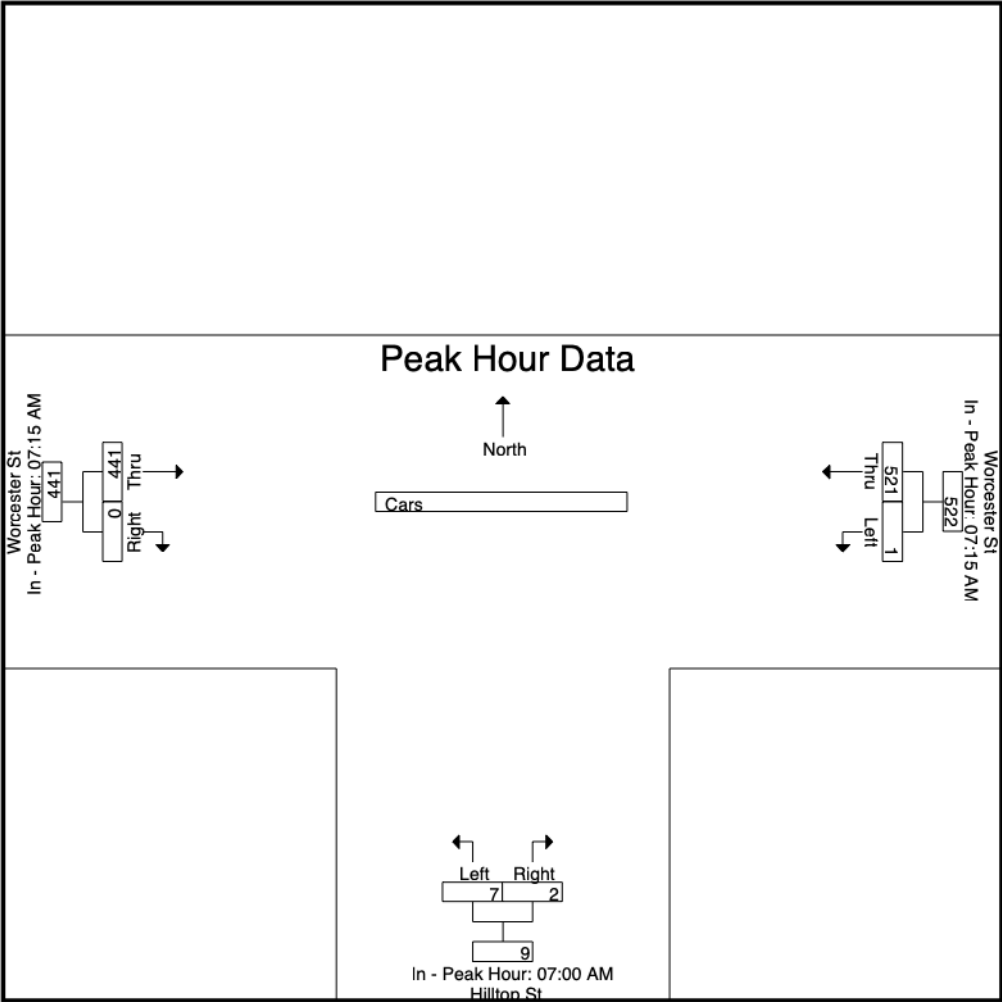
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	07:15 AM			07:00 AM			07:15 AM		
+0 mins.	0	145	145	2	1	3	96	0	96
+15 mins.	0	140	140	2	0	2	118	0	118
+30 mins.	0	118	118	2	0	2	113	0	113
+45 mins.	1	118	119	1	1	2	114	0	114
Total Volume	1	521	522	7	2	9	441	0	441
% App. Total	0.2	99.8		77.8	22.2		100	0	
PHF	.250	.898	.900	.875	.500	.750	.934	.000	.934

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150003  
Site Code : 89150003  
Start Date : 3/23/2021  
Page No : 6



# Accurate Counts

978-664-2565

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150003  
Site Code : 89150003  
Start Date : 3/23/2021  
Page No : 7

## Groups Printed- Trucks

	Worcester St From East		Hilltop St From South		Worcester St From West		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
07:00 AM	0	3	0	1	5	0	9
07:15 AM	0	4	0	0	0	0	4
07:30 AM	0	5	0	0	2	0	7
07:45 AM	0	0	0	0	5	0	5
Total	0	12	0	1	12	0	25
08:00 AM	0	7	0	0	5	0	12
08:15 AM	0	6	0	0	4	0	10
08:30 AM	0	6	0	0	5	0	11
08:45 AM	0	5	0	0	5	0	10
Total	0	24	0	0	19	0	43
Grand Total	0	36	0	1	31	0	68
Apprch %	0	100	0	100	100	0	
Total %	0	52.9	0	1.5	45.6	0	

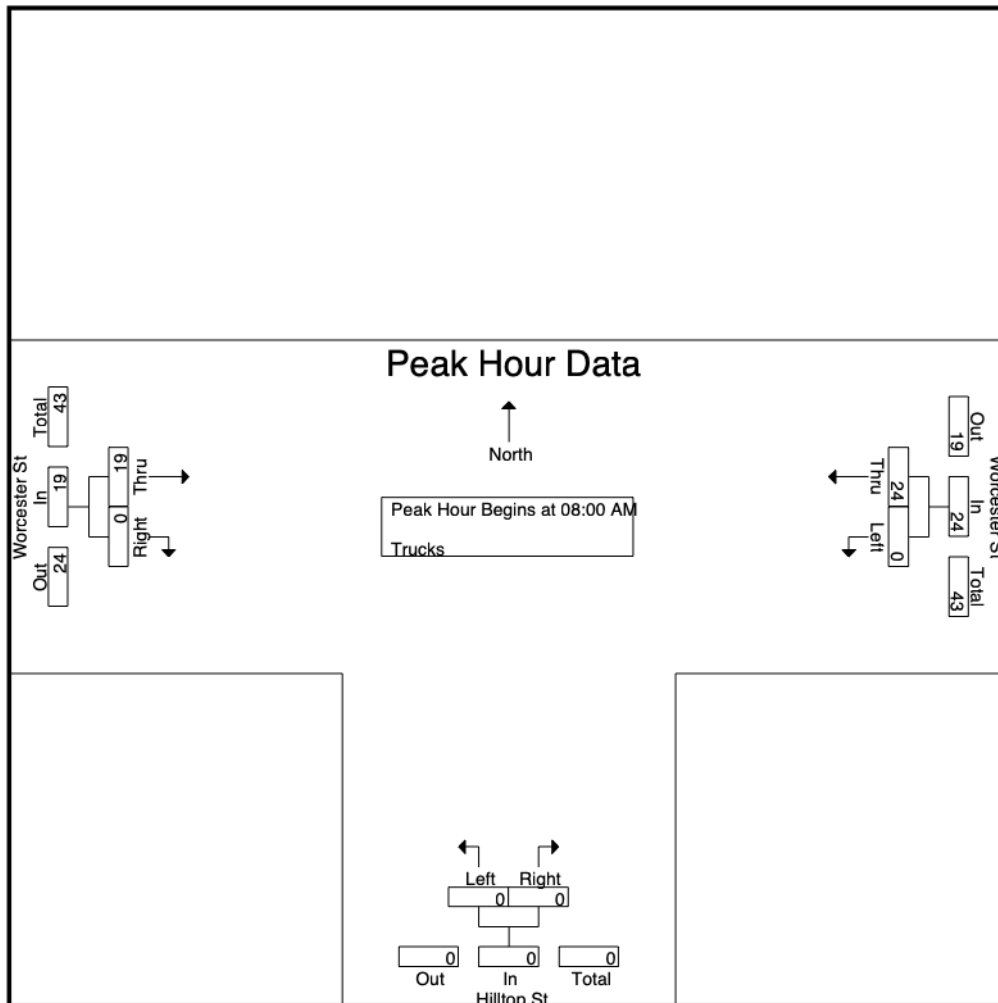
	Worcester St From East			Hilltop St From South			Worcester St From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 08:00 AM										
08:00 AM	0	7	7	0	0	0	5	0	5	12
08:15 AM	0	6	6	0	0	0	4	0	4	10
08:30 AM	0	6	6	0	0	0	5	0	5	11
08:45 AM	0	5	5	0	0	0	5	0	5	10
Total Volume	0	24	24	0	0	0	19	0	19	43
% App. Total	0	100		0	0		100	0		
PHF	.000	.857	.857	.000	.000	.000	.950	.000	.950	.896

# Accurate Counts

978-664-2565

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150003  
Site Code : 89150003  
Start Date : 3/23/2021  
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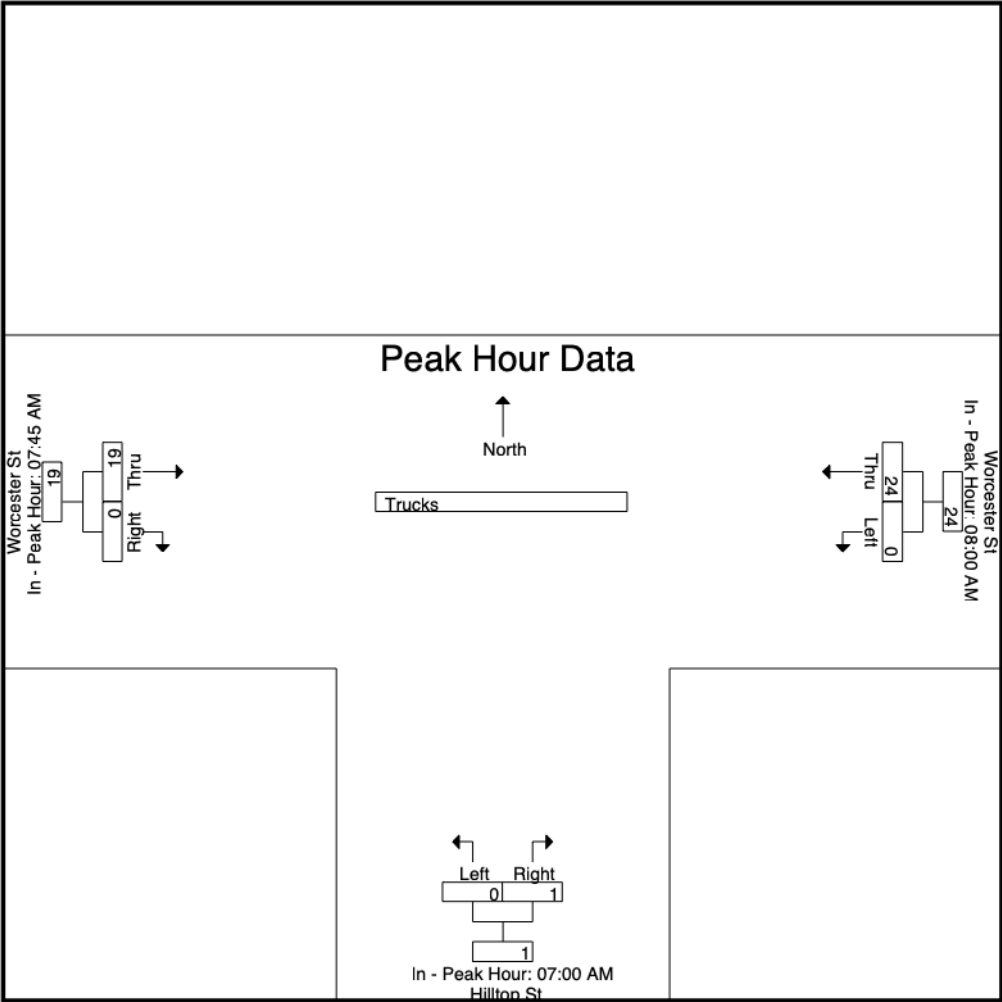
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	08:00 AM			07:00 AM			07:45 AM		
+0 mins.	0	7	7	0	1	1	5	0	5
+15 mins.	0	6	6	0	0	0	5	0	5
+30 mins.	0	6	6	0	0	0	4	0	4
+45 mins.	0	5	5	0	0	0	5	0	5
Total Volume	0	24	24	0	1	1	19	0	19
% App. Total	0	100		0	100		100	0	
PHF	.000	.857	.857	.000	.250	.250	.950	.000	.950

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150003  
Site Code : 89150003  
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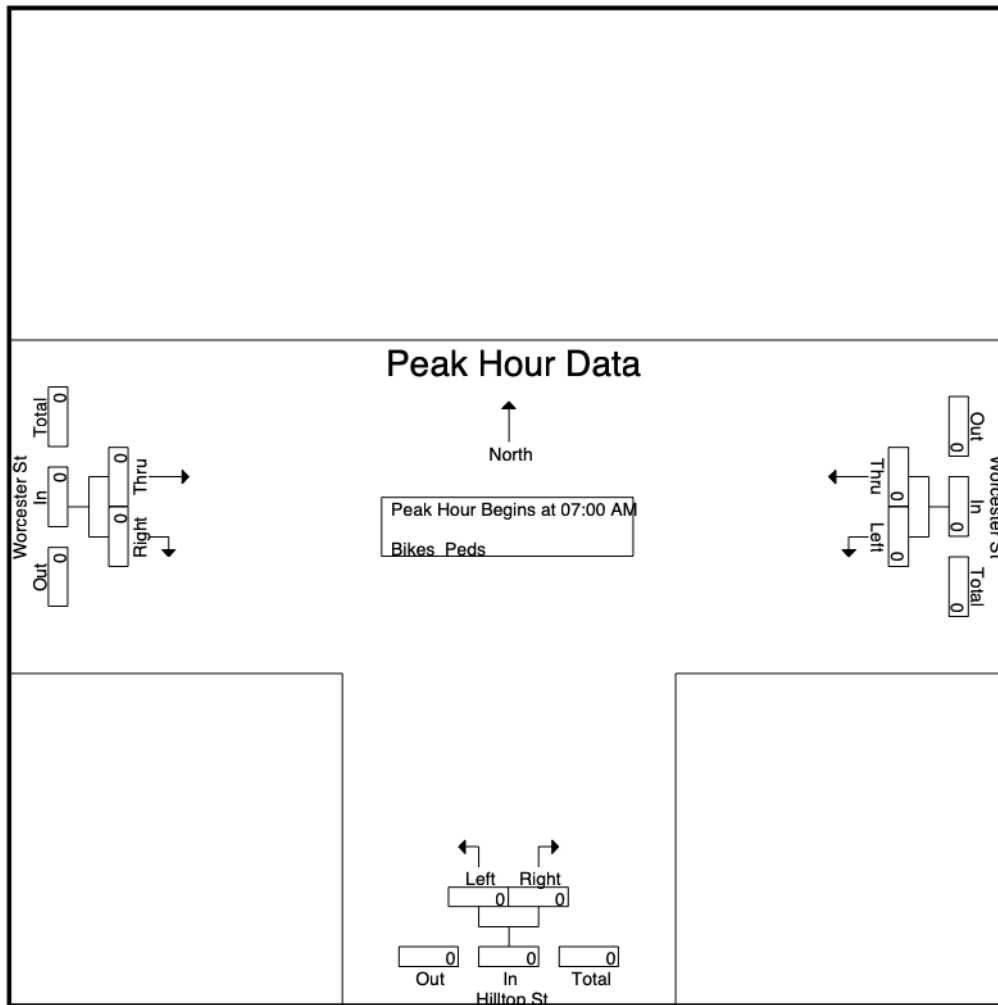
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Site Code : 89150003  
Start Date : 3/23/2021  
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978-664-2565

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150003  
Site Code : 89150003  
Start Date : 3/23/2021  
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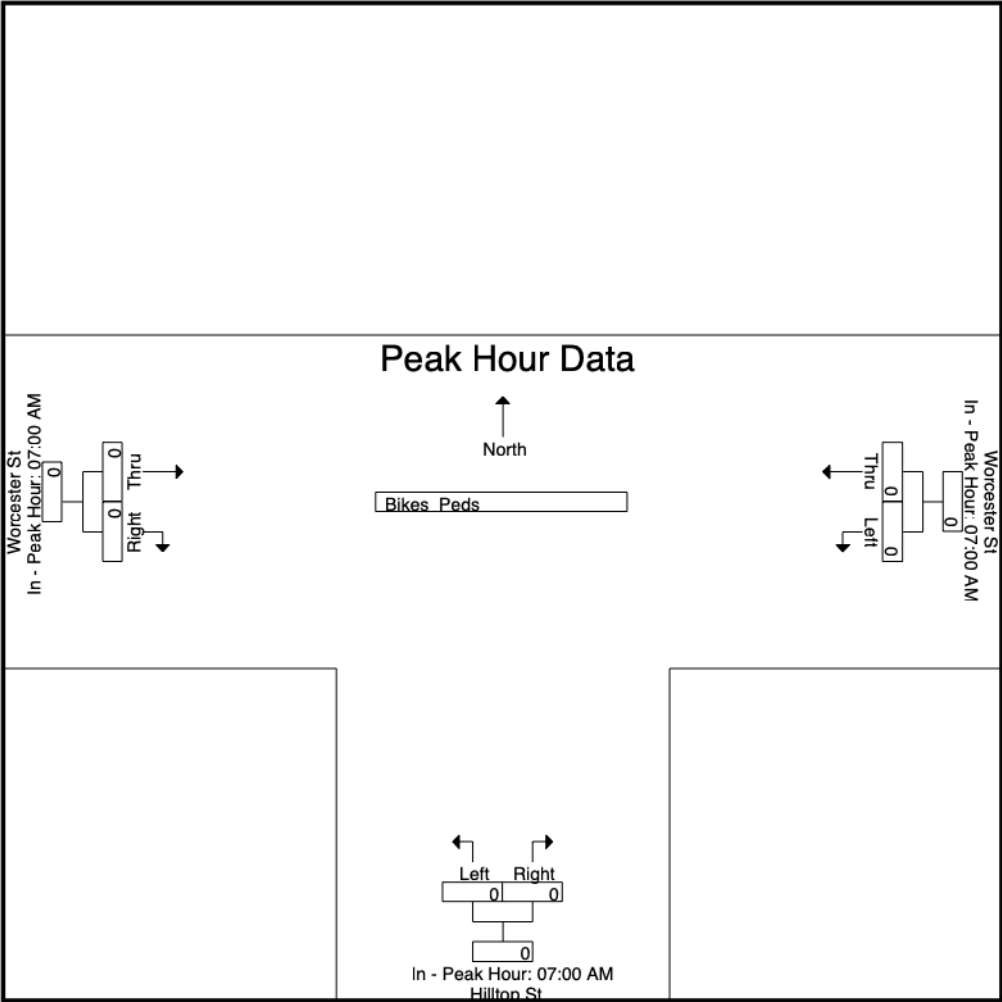
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

[illegible]

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150003  
Site Code : 89150003  
Start Date : 3/23/2021  
Page No : 12



# Accurate Counts

978-664-2565

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150003  
Site Code : 89150003  
Start Date : 3/23/2021  
Page No : 1

## Groups Printed- Cars - Trucks

	Worcester St From East		Hilltop St From South		Worcester St From West		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
04:00 PM	2	157	1	1	160	1	322
04:15 PM	0	162	1	0	166	4	333
04:30 PM	0	124	3	3	182	1	313
04:45 PM	0	145	1	1	197	1	345
Total	2	588	6	5	705	7	1313
05:00 PM	0	135	2	2	159	0	298
05:15 PM	0	156	0	0	173	2	331
05:30 PM	1	126	0	0	168	1	296
05:45 PM	0	133	0	0	147	0	280
Total	1	550	2	2	647	3	1205
Grand Total	3	1138	8	7	1352	10	2518
Apprch %	0.3	99.7	53.3	46.7	99.3	0.7	
Total %	0.1	45.2	0.3	0.3	53.7	0.4	
Cars	3	1120	8	7	1342	10	2490
% Cars	100	98.4	100	100	99.3	100	98.9
Trucks	0	18	0	0	10	0	28
% Trucks	0	1.6	0	0	0.7	0	1.1

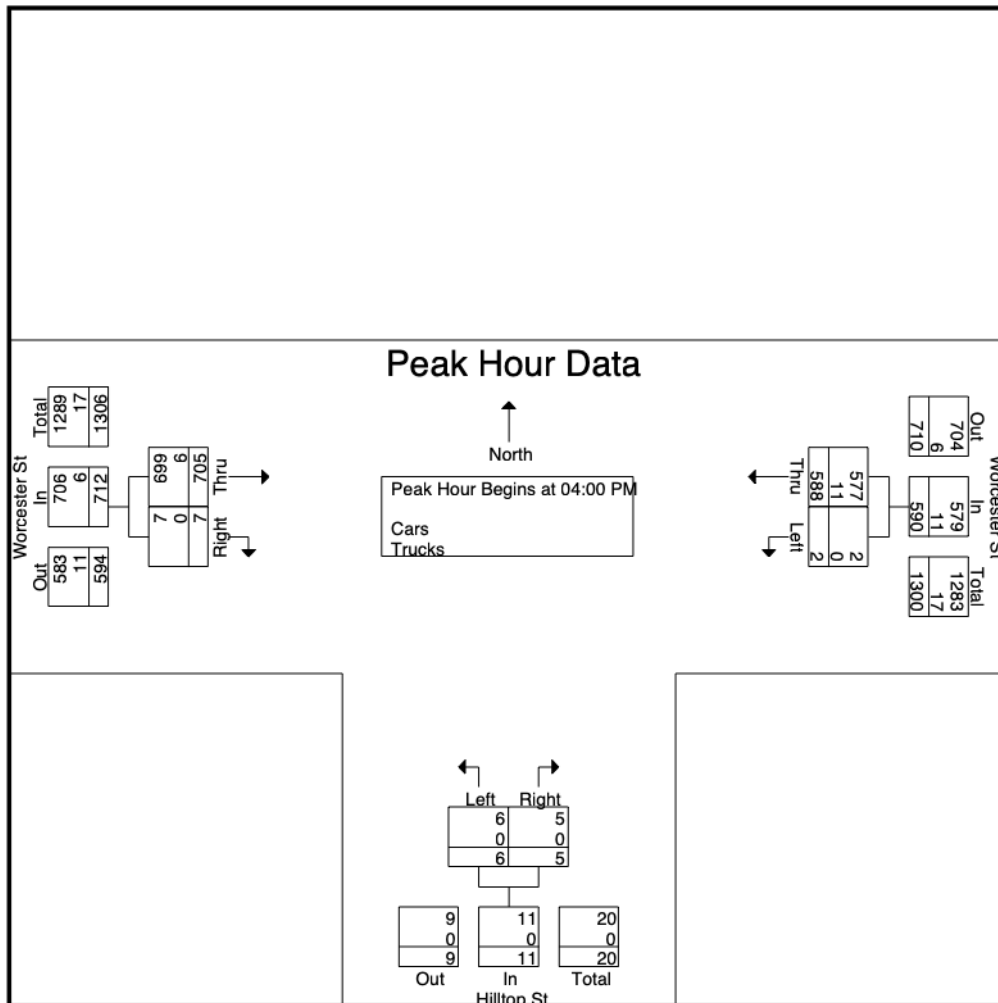
	Worcester St From East			Hilltop St From South			Worcester St From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:00 PM										
04:00 PM	2	157	159	1	1	2	160	1	161	322
04:15 PM	0	162	162	1	0	1	166	4	170	333
04:30 PM	0	124	124	3	3	6	182	1	183	313
04:45 PM	0	145	145	1	1	2	197	1	198	345
Total Volume	2	588	590	6	5	11	705	7	712	1313
% App. Total	0.3	99.7		54.5	45.5		99	1		
PHF	.250	.907	.910	.500	.417	.458	.895	.438	.899	.951
Cars	2	577	579	6	5	11	699	7	706	1296
% Cars	100	98.1	98.1	100	100	100	99.1	100	99.2	98.7
Trucks	0	11	11	0	0	0	6	0	6	17
% Trucks	0	1.9	1.9	0	0	0	0.9	0	0.8	1.3

# Accurate Counts

978-664-2565

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150003  
Site Code : 89150003  
Start Date : 3/23/2021  
Page No : 2

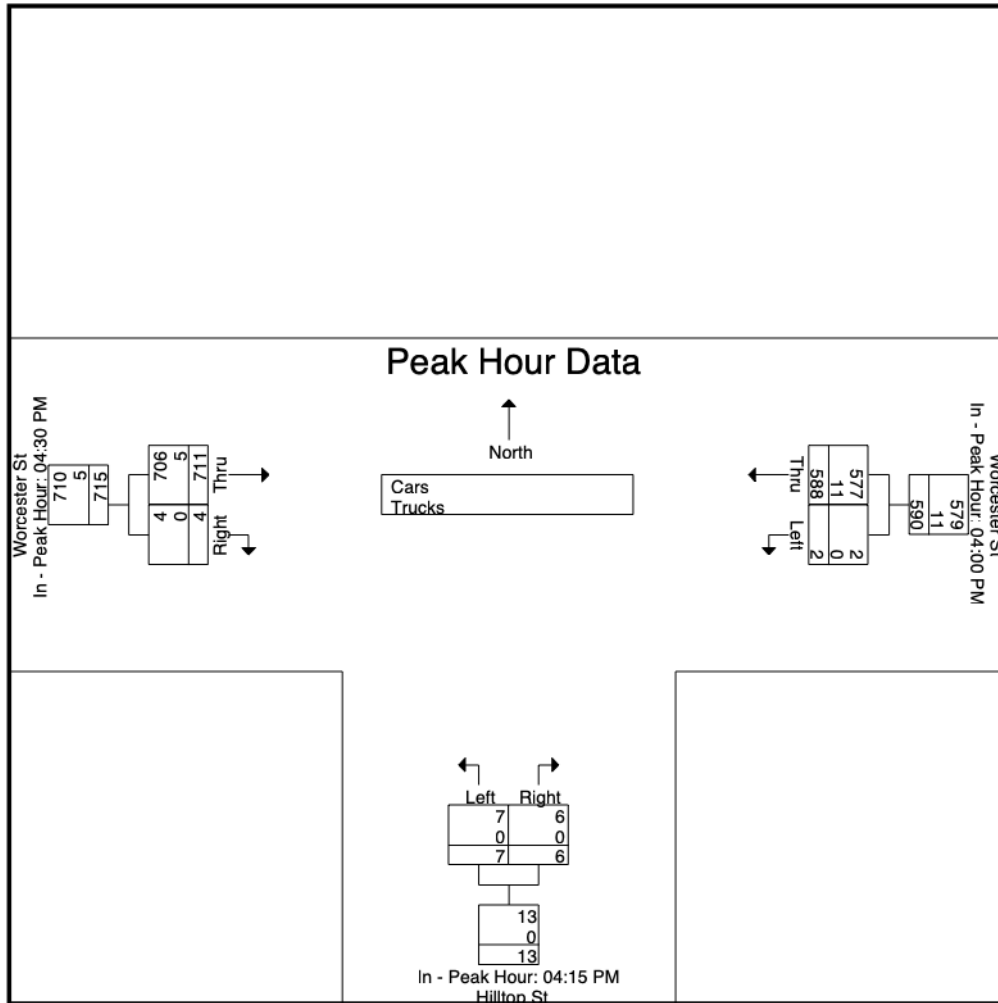


Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	04:00 PM			04:15 PM			04:30 PM		
+0 mins.	2	157	159	1	0	1	182	1	183
+15 mins.	0	162	162	3	3	6	197	1	198
+30 mins.	0	124	124	1	1	2	159	0	159
+45 mins.	0	145	145	2	2	4	173	2	175
Total Volume	2	588	590	7	6	13	711	4	715
% App. Total	0.3	99.7		53.8	46.2		99.4	0.6	
PHF	.250	.907	.910	.583	.500	.542	.902	.500	.903
Cars	2	577	579	7	6	13	706	4	710
% Cars	100	98.1	98.1	100	100	100	99.3	100	99.3
Trucks	0	11	11	0	0	0	5	0	5
% Trucks	0	1.9	1.9	0	0	0	0.7	0	0.7

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear



# Accurate Counts

978-664-2565

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150003  
Site Code : 89150003  
Start Date : 3/23/2021  
Page No : 4

## Groups Printed- Cars

	Worcester St From East		Hilltop St From South		Worcester St From West		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
04:00 PM	2	154	1	1	158	1	317
04:15 PM	0	158	1	0	165	4	328
04:30 PM	0	123	3	3	180	1	310
04:45 PM	0	142	1	1	196	1	341
Total	2	577	6	5	699	7	1296
05:00 PM	0	134	2	2	158	0	296
05:15 PM	0	155	0	0	172	2	329
05:30 PM	1	123	0	0	168	1	293
05:45 PM	0	131	0	0	145	0	276
Total	1	543	2	2	643	3	1194
Grand Total	3	1120	8	7	1342	10	2490
Apprch %	0.3	99.7	53.3	46.7	99.3	0.7	
Total %	0.1	45	0.3	0.3	53.9	0.4	

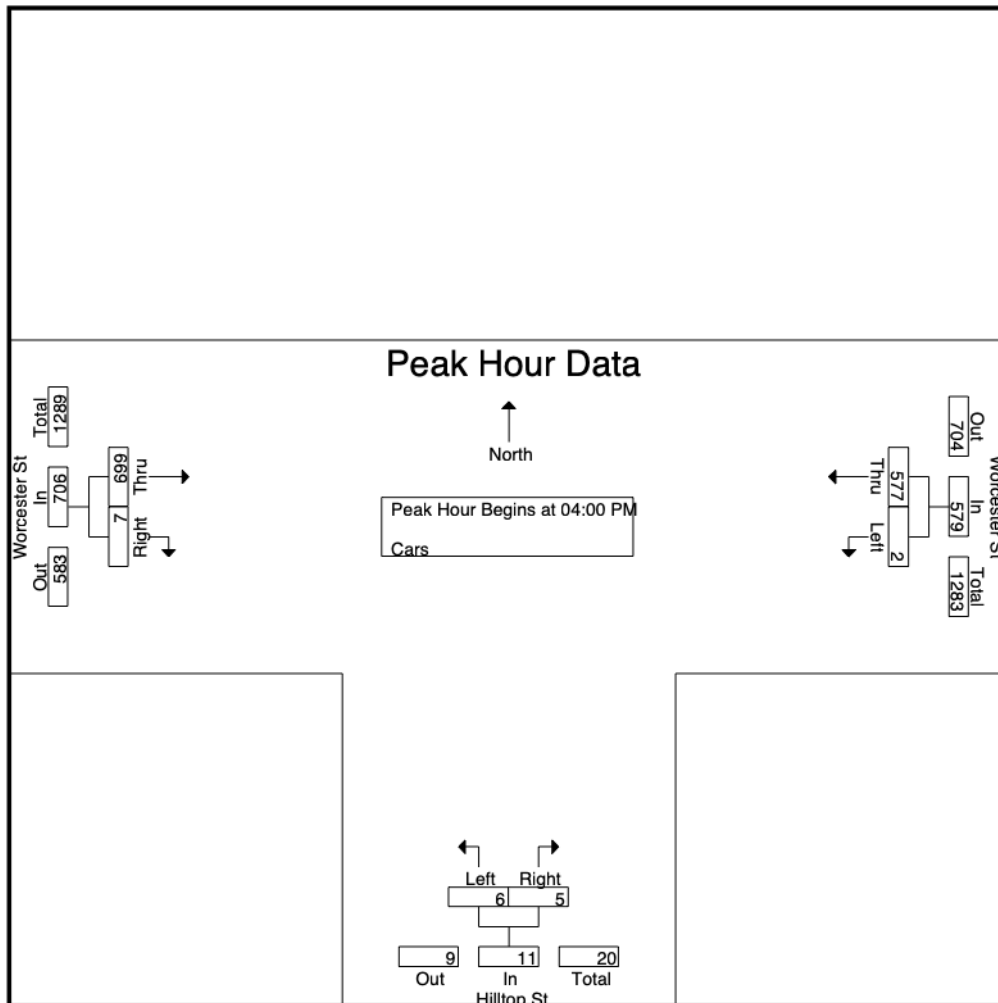
	Worcester St From East			Hilltop St From South			Worcester St From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:00 PM										
04:00 PM	2	154	156	1	1	2	158	1	159	317
04:15 PM	0	158	158	1	0	1	165	4	169	328
04:30 PM	0	123	123	3	3	6	180	1	181	310
04:45 PM	0	142	142	1	1	2	196	1	197	341
Total Volume	2	577	579	6	5	11	699	7	706	1296
% App. Total	0.3	99.7		54.5	45.5		99	1		
PHF	.250	.913	.916	.500	.417	.458	.892	.438	.896	.950

# Accurate Counts

978-664-2565

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150003  
Site Code : 89150003  
Start Date : 3/23/2021  
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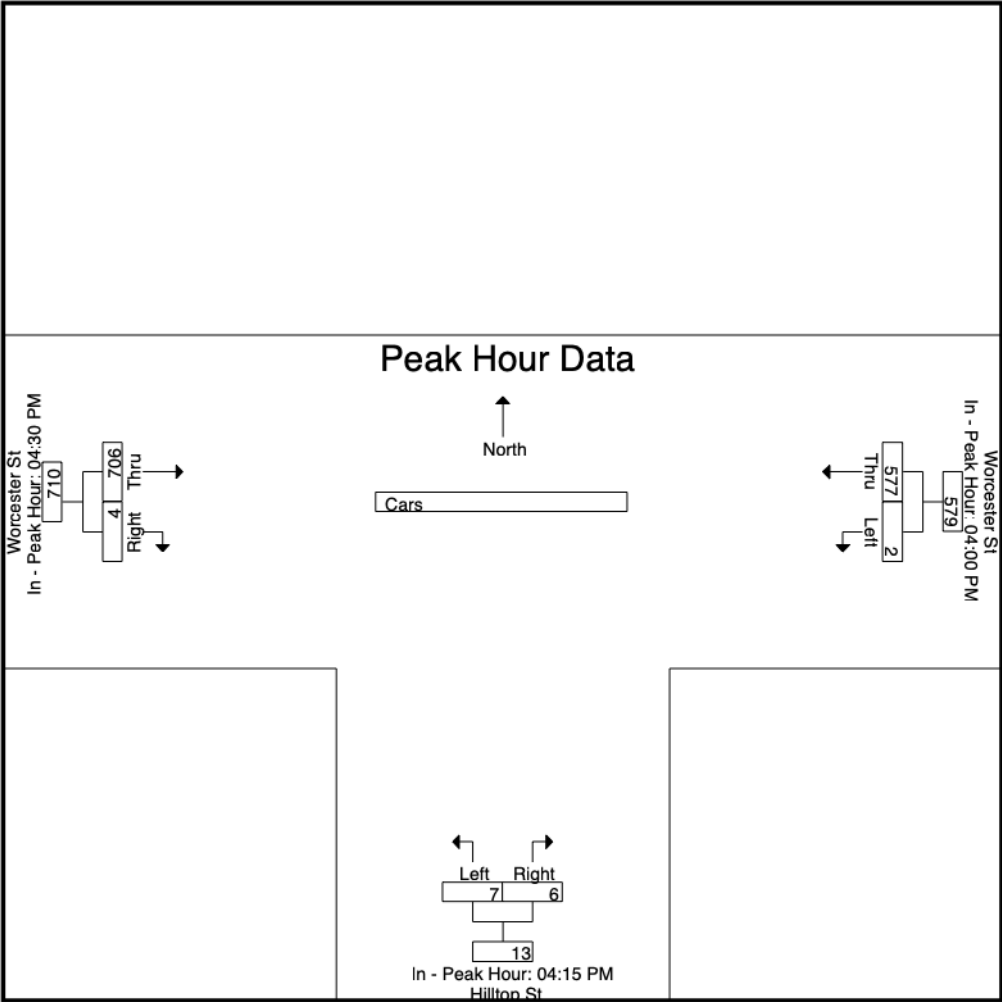
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	04:00 PM			04:15 PM			04:30 PM		
+0 mins.	2	154	156	1	0	1	180	1	181
+15 mins.	0	158	158	3	3	6	196	1	197
+30 mins.	0	123	123	1	1	2	158	0	158
+45 mins.	0	142	142	2	2	4	172	2	174
Total Volume	2	577	579	7	6	13	706	4	710
% App. Total	0.3	99.7		53.8	46.2		99.4	0.6	
PHF	.250	.913	.916	.583	.500	.542	.901	.500	.901

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150003  
Site Code : 89150003  
Start Date : 3/23/2021  
Page No : 6



# Accurate Counts

978-664-2565

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150003  
Site Code : 89150003  
Start Date : 3/23/2021  
Page No : 7

## Groups Printed- Trucks

	Worcester St From East		Hilltop St From South		Worcester St From West		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
04:00 PM	0	3	0	0	2	0	5
04:15 PM	0	4	0	0	1	0	5
04:30 PM	0	1	0	0	2	0	3
04:45 PM	0	3	0	0	1	0	4
Total	0	11	0	0	6	0	17
05:00 PM	0	1	0	0	1	0	2
05:15 PM	0	1	0	0	1	0	2
05:30 PM	0	3	0	0	0	0	3
05:45 PM	0	2	0	0	2	0	4
Total	0	7	0	0	4	0	11
Grand Total	0	18	0	0	10	0	28
Apprch %	0	100	0	0	100	0	
Total %	0	64.3	0	0	35.7	0	

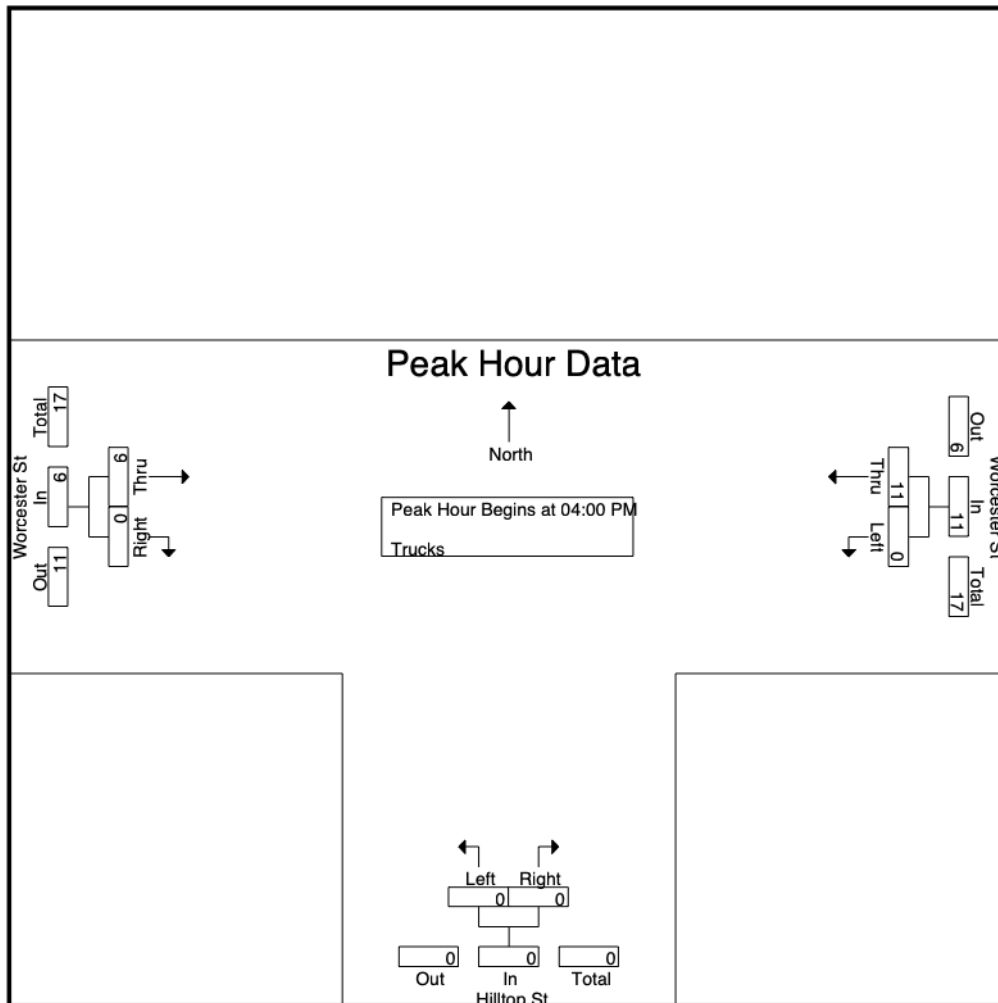
	Worcester St From East			Hilltop St From South			Worcester St From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:00 PM										
04:00 PM	0	3	3	0	0	0	2	0	2	5
04:15 PM	0	4	4	0	0	0	1	0	1	5
04:30 PM	0	1	1	0	0	0	2	0	2	3
04:45 PM	0	3	3	0	0	0	1	0	1	4
Total Volume	0	11	11	0	0	0	6	0	6	17
% App. Total	0	100		0	0		100	0		
PHF	.000	.688	.688	.000	.000	.000	.750	.000	.750	.850

# Accurate Counts

978-664-2565

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150003  
Site Code : 89150003  
Start Date : 3/23/2021  
Page No : 8

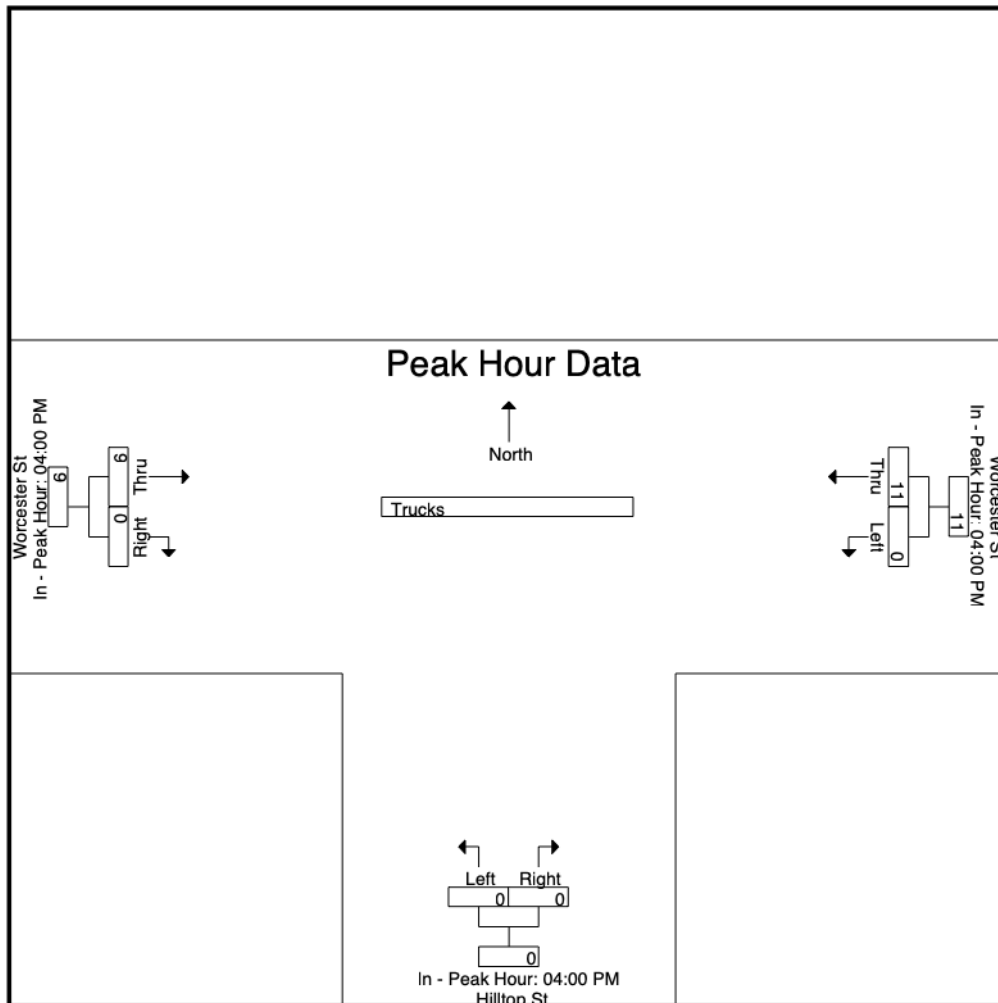


Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	04:00 PM			04:00 PM			04:00 PM		
+0 mins.	0	3	3	0	0	0	2	0	2
+15 mins.	0	4	4	0	0	0	1	0	1
+30 mins.	0	1	1	0	0	0	2	0	2
+45 mins.	0	3	3	0	0	0	1	0	1
Total Volume	0	11	11	0	0	0	6	0	6
% App. Total	0	100		0	0		100	0	
PHF	.000	.688	.688	.000	.000	.000	.750	.000	.750

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear



# Accurate Counts

978-664-2565

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150003  
Site Code : 89150003  
Start Date : 3/23/2021  
Page No : 10

## Groups Printed- Bikes Peds

	Worcester St From East			Hilltop St From South			Worcester St From West					
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
04:00 PM	0	1	0	0	0	3	0	0	0	3	1	4
04:15 PM	0	0	0	0	0	0	1	0	0	0	1	1
04:30 PM	0	1	0	0	0	0	0	0	0	0	1	1
04:45 PM	0	0	0	0	0	0	1	0	0	0	1	1
Total	0	2	0	0	0	3	2	0	0	3	4	7
05:00 PM	0	1	0	0	0	0	1	0	0	0	2	2
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	4	0	0	0	4	0	4
Total	0	1	0	0	0	4	1	0	0	4	2	6
Grand Total	0	3	0	0	0	7	3	0	0	7	6	13
Apprch %	0	100		0	0		100	0				
Total %	0	50		0	0		50	0		53.8	46.2	

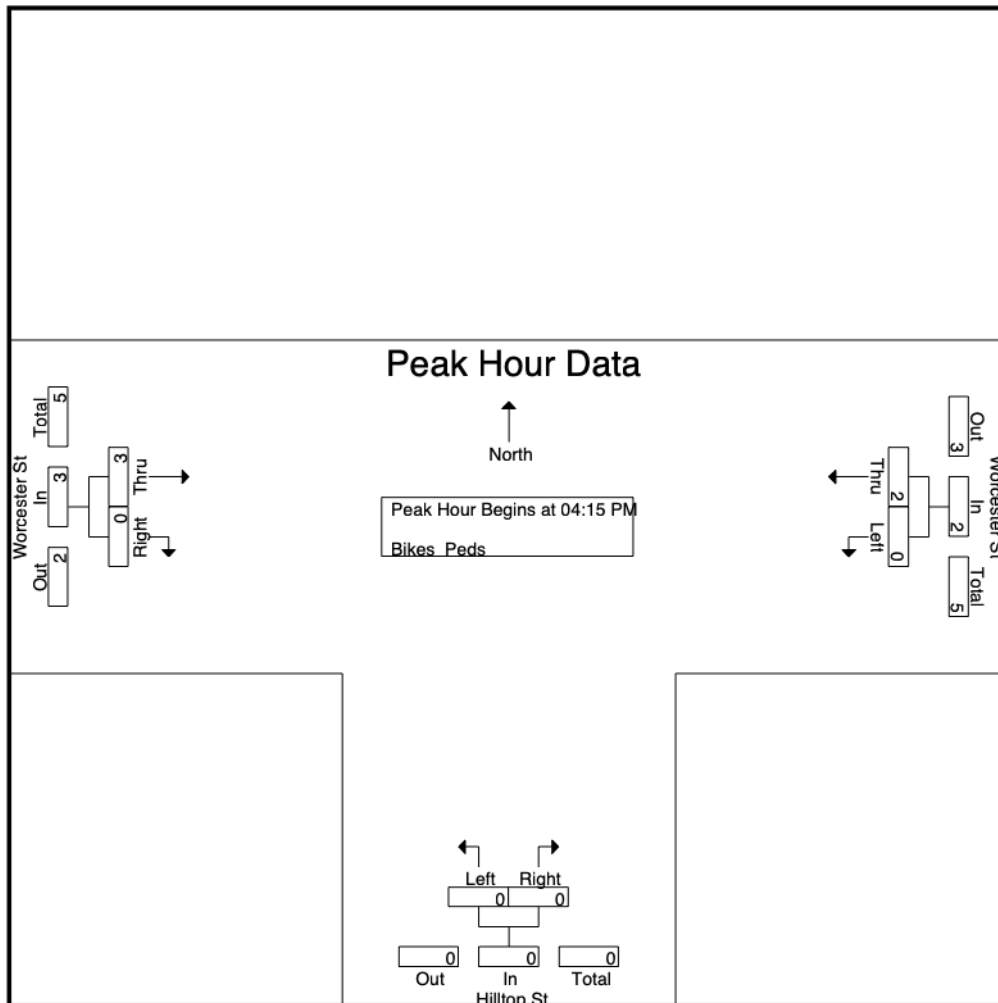
	Worcester St From East			Hilltop St From South			Worcester St From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:15 PM										
04:15 PM	0	0	0	0	0	0	1	0	1	1
04:30 PM	0	1	1	0	0	0	0	0	0	1
04:45 PM	0	0	0	0	0	0	1	0	1	1
05:00 PM	0	1	1	0	0	0	1	0	1	2
Total Volume	0	2	2	0	0	0	3	0	3	5
% App. Total	0	100		0	0		100	0		
PHF	.000	.500	.500	.000	.000	.000	.750	.000	.750	.625

# Accurate Counts

978-664-2565

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150003  
Site Code : 89150003  
Start Date : 3/23/2021  
Page No : 11

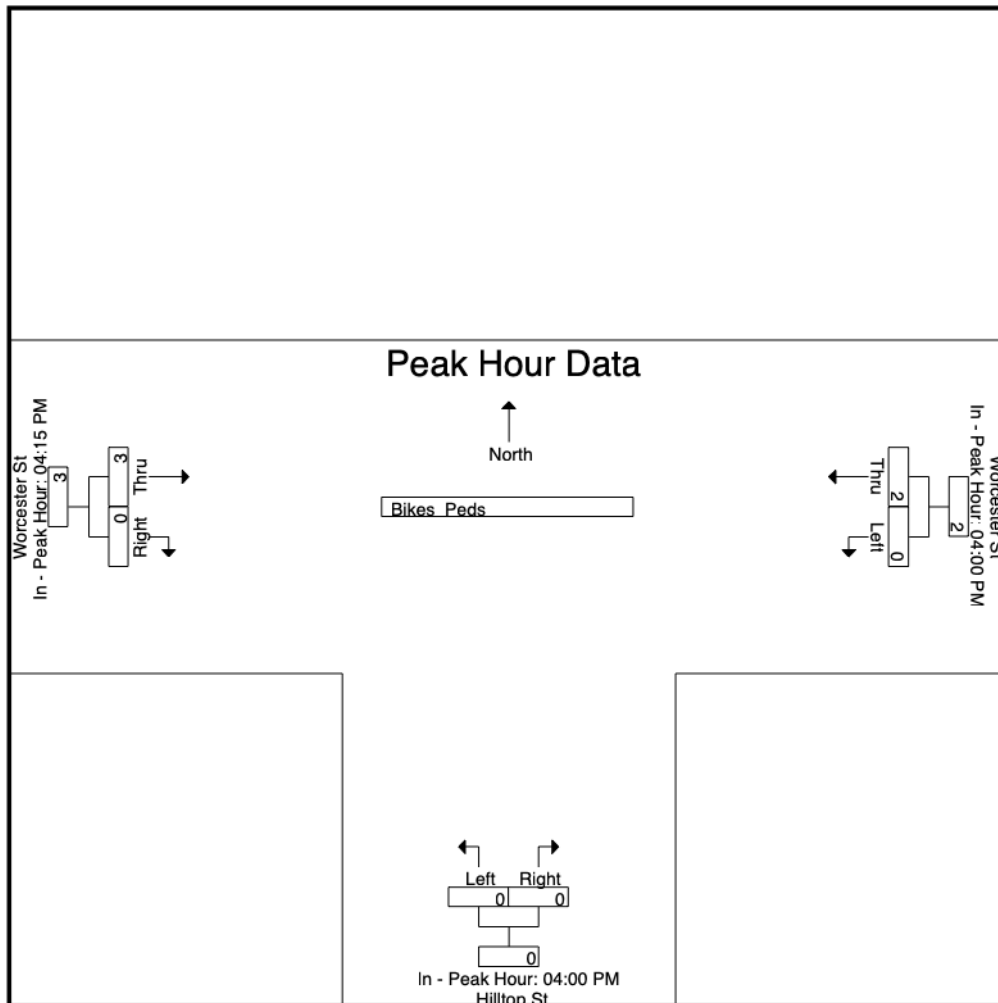


Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	04:00 PM			04:00 PM			04:15 PM		
+0 mins.	0	1	1	0	0	0	1	0	1
+15 mins.	0	0	0	0	0	0	0	0	0
+30 mins.	0	1	1	0	0	0	1	0	1
+45 mins.	0	0	0	0	0	0	1	0	1
Total Volume	0	2	2	0	0	0	3	0	3
% App. Total	0	100		0	0		100	0	
PHF	.000	.500	.500	.000	.000	.000	.750	.000	.750

N/S Street : Hilltop Street  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear



# Accurate Counts

978-664-2565

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150004  
Site Code : 89150004  
Start Date : 3/23/2021  
Page No : 1

## Groups Printed- Cars - Trucks

	Dwy From North			Worcester St From East			I-90 Ramp From South			Worcester St From West			Int. Total
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:00 AM	0	0	0	72	43	0	59	0	56	0	52	103	385
07:15 AM	0	0	0	78	74	0	71	0	45	0	52	95	415
07:30 AM	0	0	0	71	79	0	70	0	64	0	58	101	443
07:45 AM	0	0	0	54	69	0	90	0	62	0	54	89	418
Total	0	0	0	275	265	0	290	0	227	0	216	388	1661
08:00 AM	0	0	0	61	73	0	58	0	66	0	65	87	410
08:15 AM	0	0	1	51	67	0	62	0	44	0	51	82	358
08:30 AM	0	0	0	47	72	0	53	1	44	0	48	77	342
08:45 AM	0	0	0	42	63	0	67	0	49	0	63	65	349
Total	0	0	1	201	275	0	240	1	203	0	227	311	1459
Grand Total	0	0	1	476	540	0	530	1	430	0	443	699	3120
Apprch %	0	0	100	46.9	53.1	0	55.2	0.1	44.7	0	38.8	61.2	
Total %	0	0	0	15.3	17.3	0	17	0	13.8	0	14.2	22.4	
Cars	0	0	1	447	528	0	462	1	405	0	433	610	2887
% Cars	0	0	100	93.9	97.8	0	87.2	100	94.2	0	97.7	87.3	92.5
Trucks	0	0	0	29	12	0	68	0	25	0	10	89	233
% Trucks	0	0	0	6.1	2.2	0	12.8	0	5.8	0	2.3	12.7	7.5

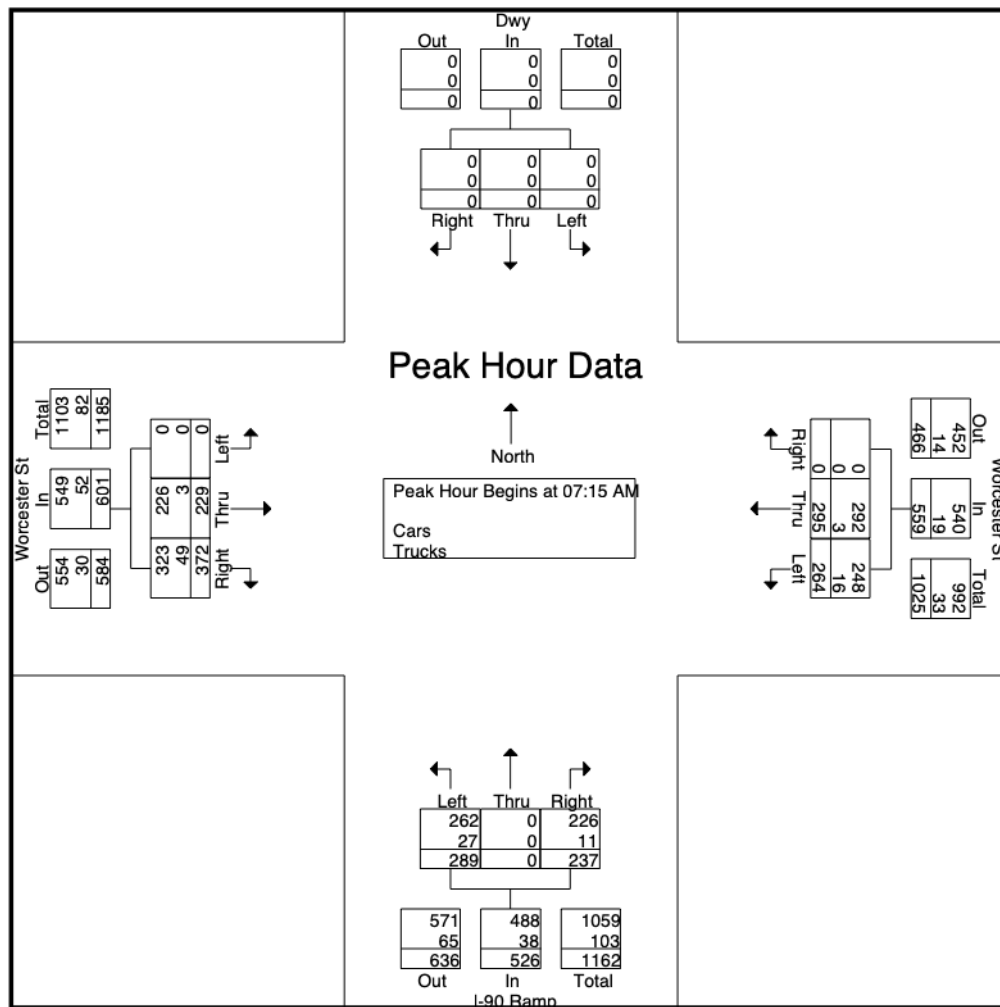
	Dwy From North				Worcester St From East				I-90 Ramp From South				Worcester St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	0	0	0	0	78	74	0	152	71	0	45	116	0	52	95	147	415
07:30 AM	0	0	0	0	71	79	0	150	70	0	64	134	0	58	101	159	443
07:45 AM	0	0	0	0	54	69	0	123	90	0	62	152	0	54	89	143	418
08:00 AM	0	0	0	0	61	73	0	134	58	0	66	124	0	65	87	152	410
Total Volume	0	0	0	0	264	295	0	559	289	0	237	526	0	229	372	601	1686
% App. Total	0	0	0		47.2	52.8	0		54.9	0	45.1		0	38.1	61.9		
PHF	.000	.000	.000	.000	.846	.934	.000	.919	.803	.000	.898	.865	.000	.881	.921	.945	.951
Cars	0	0	0	0	248	292	0	540	262	0	226	488	0	226	323	549	1577
% Cars	0	0	0	0	93.9	99.0	0	96.6	90.7	0	95.4	92.8	0	98.7	86.8	91.3	93.5
Trucks	0	0	0	0	16	3	0	19	27	0	11	38	0	3	49	52	109
% Trucks	0	0	0	0	6.1	1.0	0	3.4	9.3	0	4.6	7.2	0	1.3	13.2	8.7	6.5

# Accurate Counts

978-664-2565

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150004  
Site Code : 89150004  
Start Date : 3/23/2021  
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1  
Peak Hour for Each Approach Begins at:

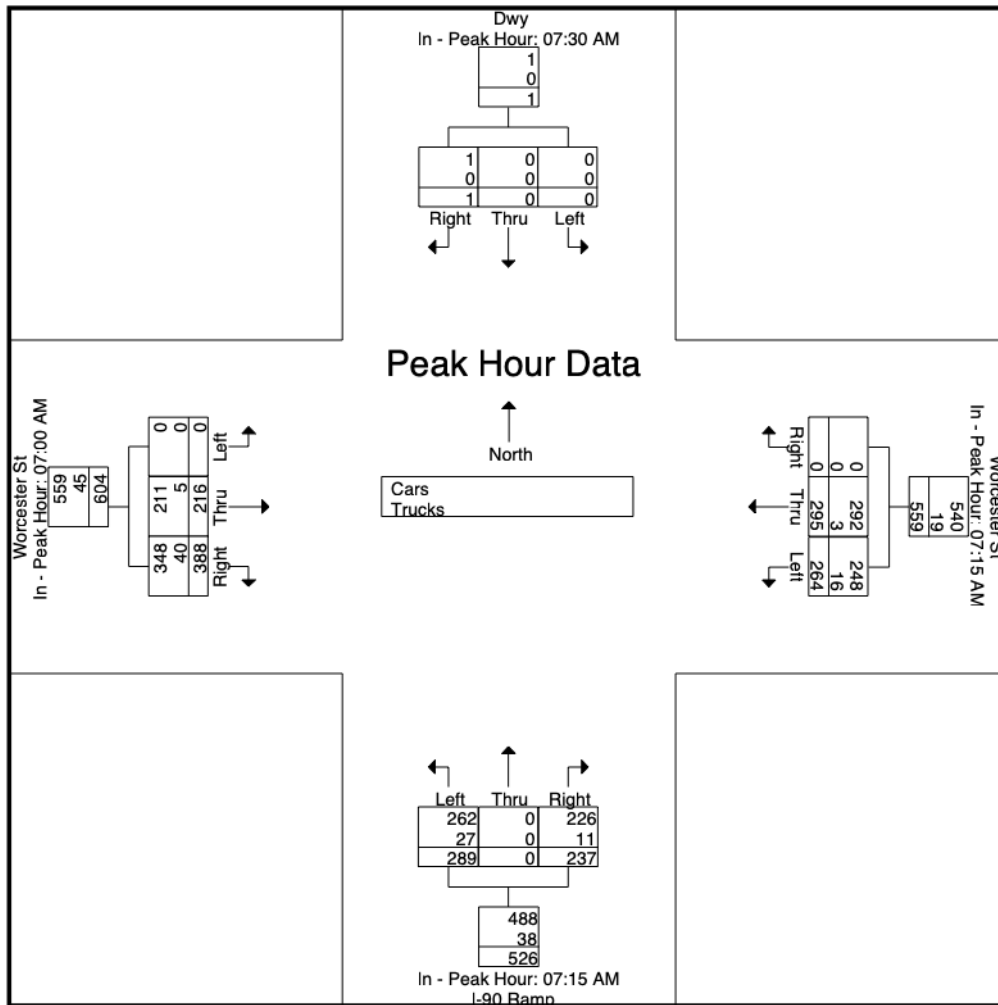
	07:30 AM				07:15 AM				07:15 AM				07:00 AM			
+0 mins.	0	0	0	0	<b>78</b>	74	0	<b>152</b>	71	0	45	116	0	52	<b>103</b>	155
+15 mins.	0	0	0	0	71	<b>79</b>	0	150	70	0	64	134	0	52	95	147
+30 mins.	0	0	0	0	54	69	0	123	<b>90</b>	0	62	<b>152</b>	0	<b>58</b>	101	<b>159</b>
+45 mins.	0	0	1	1	61	73	0	134	58	0	<b>66</b>	124	0	54	89	143
Total Volume	0	0	1	1	264	295	0	559	289	0	237	526	0	216	388	604
% App. Total	0	0	100		47.2	52.8	0		54.9	0	45.1		0	35.8	64.2	
PHF	.000	.000	.250	.250	.846	.934	.000	.919	.803	.000	.898	.865	.000	.931	.942	.950
Cars	0	0	1	1	248	292	0	540	262	0	226	488	0	211	348	559
% Cars	0	0	100	100	93.9	99	0	96.6	90.7	0	95.4	92.8	0	97.7	89.7	92.5
Trucks	0	0	0	0	16	3	0	19	27	0	11	38	0	5	40	45
% Trucks	0	0	0	0	6.1	1	0	3.4	9.3	0	4.6	7.2	0	2.3	10.3	7.5

# Accurate Counts

978-664-2565

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150004  
Site Code : 89150004  
Start Date : 3/23/2021  
Page No : 3



# Accurate Counts

978-664-2565

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150004  
Site Code : 89150004  
Start Date : 3/23/2021  
Page No : 4

## Groups Printed- Cars

	Dwy From North			Worcester St From East			I-90 Ramp From South			Worcester St From West			Int. Total
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:00 AM	0	0	0	68	42	0	49	0	52	0	50	96	357
07:15 AM	0	0	0	74	74	0	64	0	45	0	52	84	393
07:30 AM	0	0	0	67	79	0	60	0	63	0	57	92	418
07:45 AM	0	0	0	52	69	0	85	0	59	0	52	76	393
Total	0	0	0	261	264	0	258	0	219	0	211	348	1561
08:00 AM	0	0	0	55	70	0	53	0	59	0	65	71	373
08:15 AM	0	0	1	50	63	0	49	0	42	0	48	74	327
08:30 AM	0	0	0	42	69	0	45	1	41	0	46	64	308
08:45 AM	0	0	0	39	62	0	57	0	44	0	63	53	318
Total	0	0	1	186	264	0	204	1	186	0	222	262	1326
Grand Total	0	0	1	447	528	0	462	1	405	0	433	610	2887
Apprch %	0	0	100	45.8	54.2	0	53.2	0.1	46.7	0	41.5	58.5	
Total %	0	0	0	15.5	18.3	0	16	0	14	0	15	21.1	

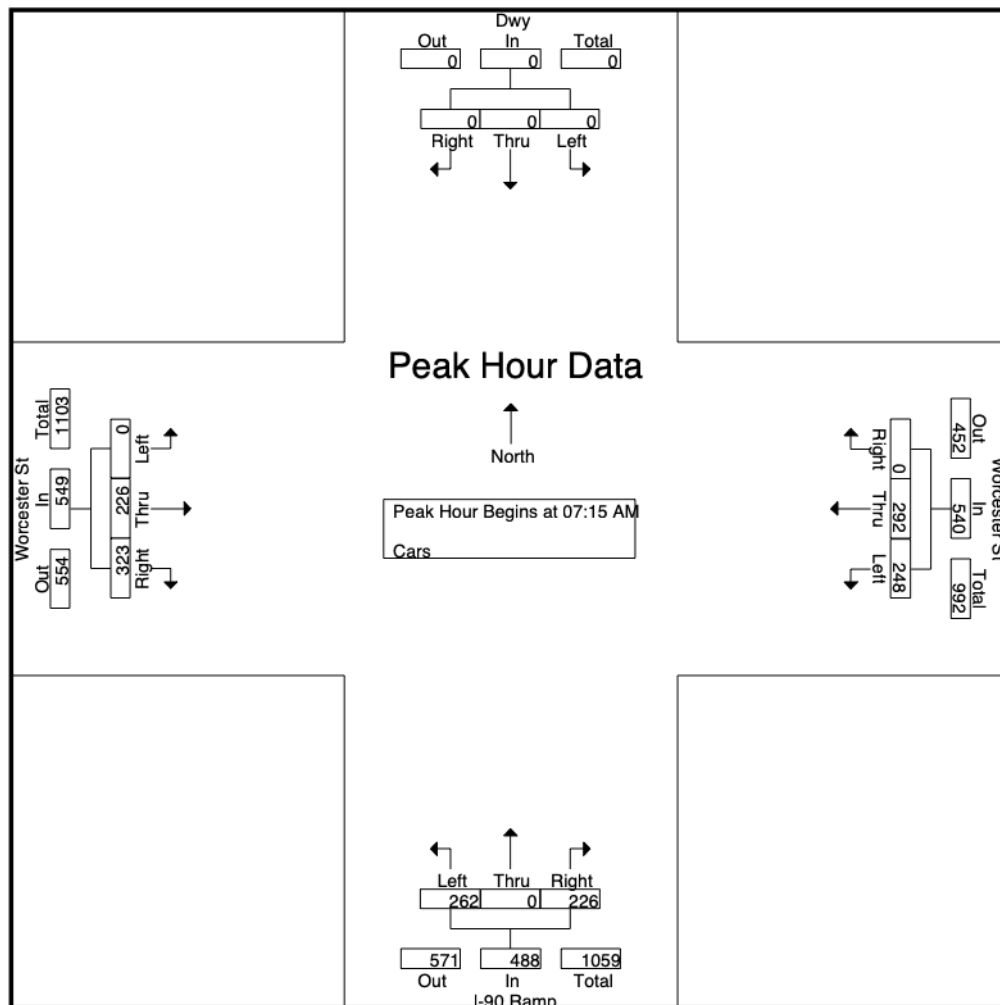
	Dwy From North				Worcester St From East				I-90 Ramp From South				Worcester St From West				Int. Total
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	0	0	0	0	74	74	0	148	64	0	45	109	0	52	84	136	393
07:30 AM	0	0	0	0	67	79	0	146	60	0	63	123	0	57	92	149	418
07:45 AM	0	0	0	0	52	69	0	121	85	0	59	144	0	52	76	128	393
08:00 AM	0	0	0	0	55	70	0	125	53	0	59	112	0	65	71	136	373
Total Volume	0	0	0	0	248	292	0	540	262	0	226	488	0	226	323	549	1577
% App. Total	0	0	0		45.9	54.1	0		53.7	0	46.3		0	41.2	58.8		
PHF	.000	.000	.000	.000	.838	.924	.000	.912	.771	.000	.897	.847	.000	.869	.878	.921	.943

# Accurate Counts

978-664-2565

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150004  
Site Code : 89150004  
Start Date : 3/23/2021  
Page No : 5

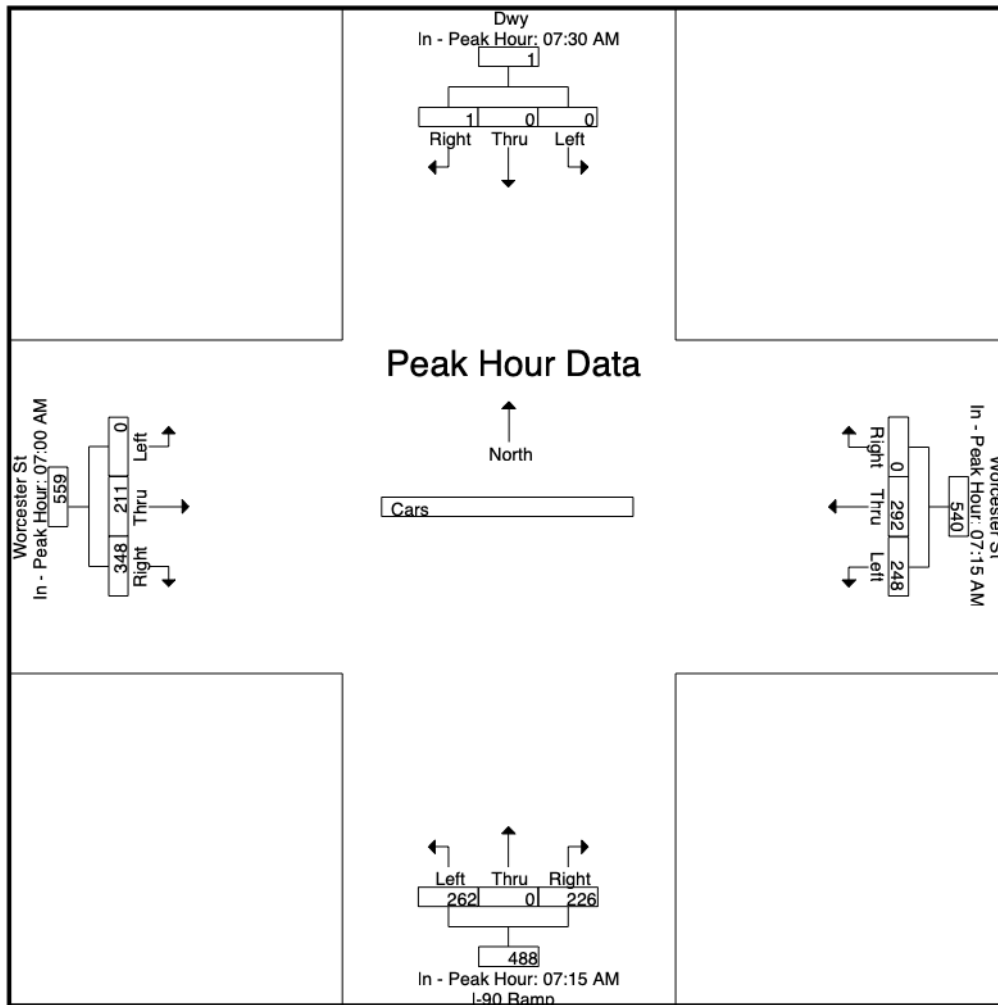


Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	07:30 AM				07:15 AM				07:15 AM				07:00 AM			
+0 mins.	0	0	0	0	<b>74</b>	74	0	<b>148</b>	64	0	45	109	0	50	<b>96</b>	146
+15 mins.	0	0	0	0	67	<b>79</b>	0	146	60	0	<b>63</b>	123	0	52	84	136
+30 mins.	0	0	0	0	52	69	0	121	<b>85</b>	0	59	<b>144</b>	0	<b>57</b>	92	<b>149</b>
+45 mins.	0	0	1	1	55	70	0	125	53	0	59	112	0	52	76	128
Total Volume	0	0	1	1	248	292	0	540	262	0	226	488	0	211	348	559
% App. Total	0	0	100		45.9	54.1	0		53.7	0	46.3		0	37.7	62.3	
PHF	.000	.000	.250	.250	.838	.924	.000	.912	.771	.000	.897	.847	.000	.925	.906	.938

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear



# Accurate Counts

978-664-2565

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150004  
Site Code : 89150004  
Start Date : 3/23/2021  
Page No : 7

## Groups Printed- Trucks

	Dwy From North			Worcester St From East			I-90 Ramp From South			Worcester St From West			Int. Total
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:00 AM	0	0	0	4	1	0	10	0	4	0	2	7	28
07:15 AM	0	0	0	4	0	0	7	0	0	0	0	11	22
07:30 AM	0	0	0	4	0	0	10	0	1	0	1	9	25
07:45 AM	0	0	0	2	0	0	5	0	3	0	2	13	25
Total	0	0	0	14	1	0	32	0	8	0	5	40	100
08:00 AM	0	0	0	6	3	0	5	0	7	0	0	16	37
08:15 AM	0	0	0	1	4	0	13	0	2	0	3	8	31
08:30 AM	0	0	0	5	3	0	8	0	3	0	2	13	34
08:45 AM	0	0	0	3	1	0	10	0	5	0	0	12	31
Total	0	0	0	15	11	0	36	0	17	0	5	49	133
Grand Total	0	0	0	29	12	0	68	0	25	0	10	89	233
Apprch %	0	0	0	70.7	29.3	0	73.1	0	26.9	0	10.1	89.9	
Total %	0	0	0	12.4	5.2	0	29.2	0	10.7	0	4.3	38.2	

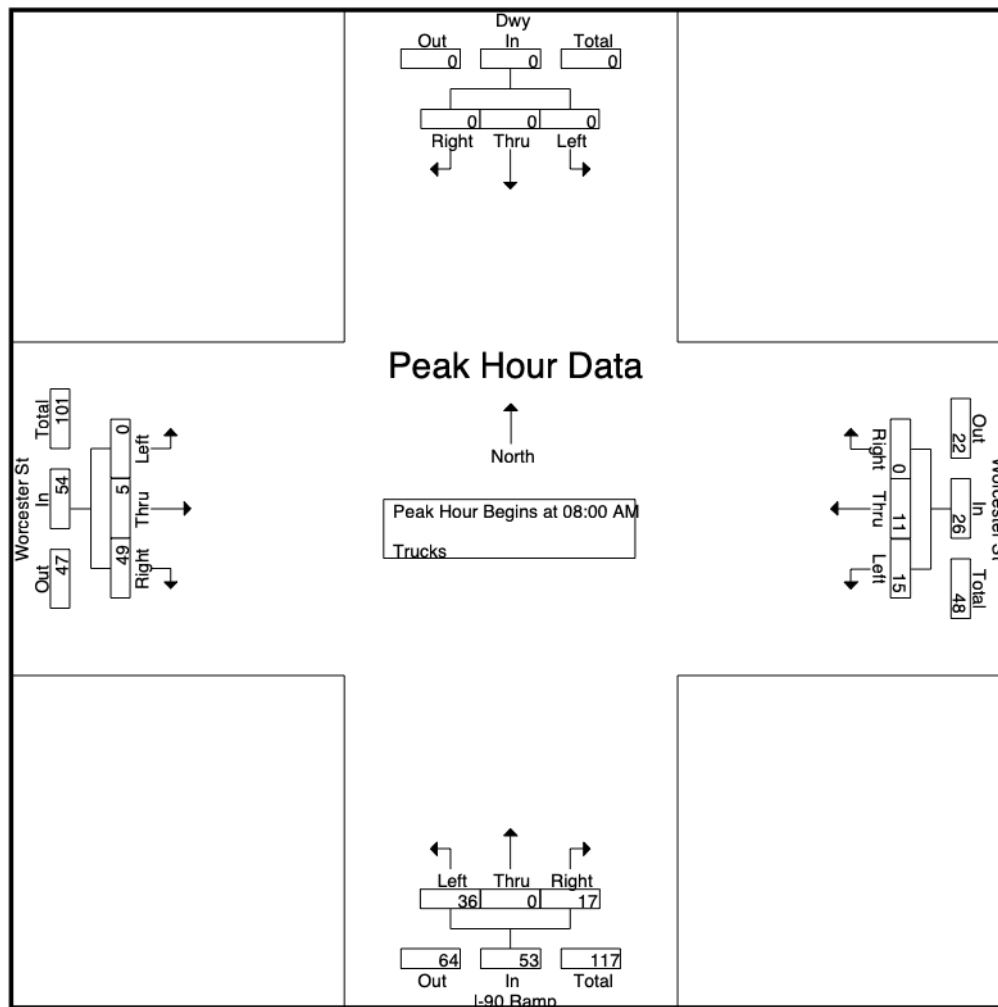
	Dwy From North				Worcester St From East				I-90 Ramp From South				Worcester St From West				Int. Total
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	0	0	0	0	6	3	0	9	5	0	7	12	0	0	16	16	37
08:15 AM	0	0	0	0	1	4	0	5	13	0	2	15	0	3	8	11	31
08:30 AM	0	0	0	0	5	3	0	8	8	0	3	11	0	2	13	15	34
08:45 AM	0	0	0	0	3	1	0	4	10	0	5	15	0	0	12	12	31
Total Volume	0	0	0	0	15	11	0	26	36	0	17	53	0	5	49	54	133
% App. Total	0	0	0		57.7	42.3	0		67.9	0	32.1		0	9.3	90.7		
PHF	.000	.000	.000	.000	.625	.688	.000	.722	.692	.000	.607	.883	.000	.417	.766	.844	.899

# Accurate Counts

978-664-2565

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

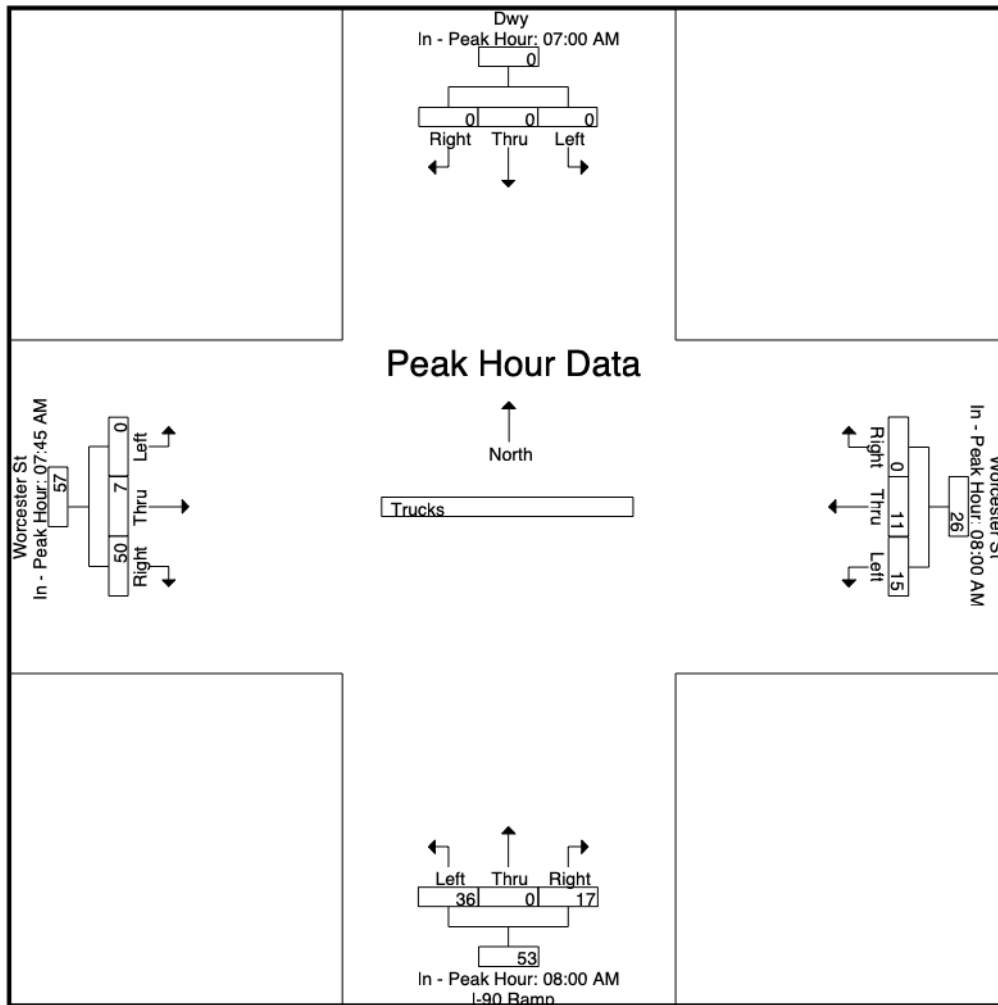
File Name : 89150004  
Site Code : 89150004  
Start Date : 3/23/2021  
Page No : 8



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1  
Peak Hour for Each Approach Begins at:

	07:00 AM				08:00 AM				08:00 AM				07:45 AM			
+0 mins.	0	0	0	0	6	3	0	9	5	0	7	12	0	2	13	15
+15 mins.	0	0	0	0	1	4	0	5	13	0	2	15	0	0	16	16
+30 mins.	0	0	0	0	5	3	0	8	8	0	3	11	0	3	8	11
+45 mins.	0	0	0	0	3	1	0	4	10	0	5	15	0	2	13	15
Total Volume	0	0	0	0	15	11	0	26	36	0	17	53	0	7	50	57
% App. Total	0	0	0	0	57.7	42.3	0		67.9	0	32.1		0	12.3	87.7	
PHF	.000	.000	.000	.000	.625	.688	.000	.722	.692	.000	.607	.883	.000	.583	.781	.891

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear



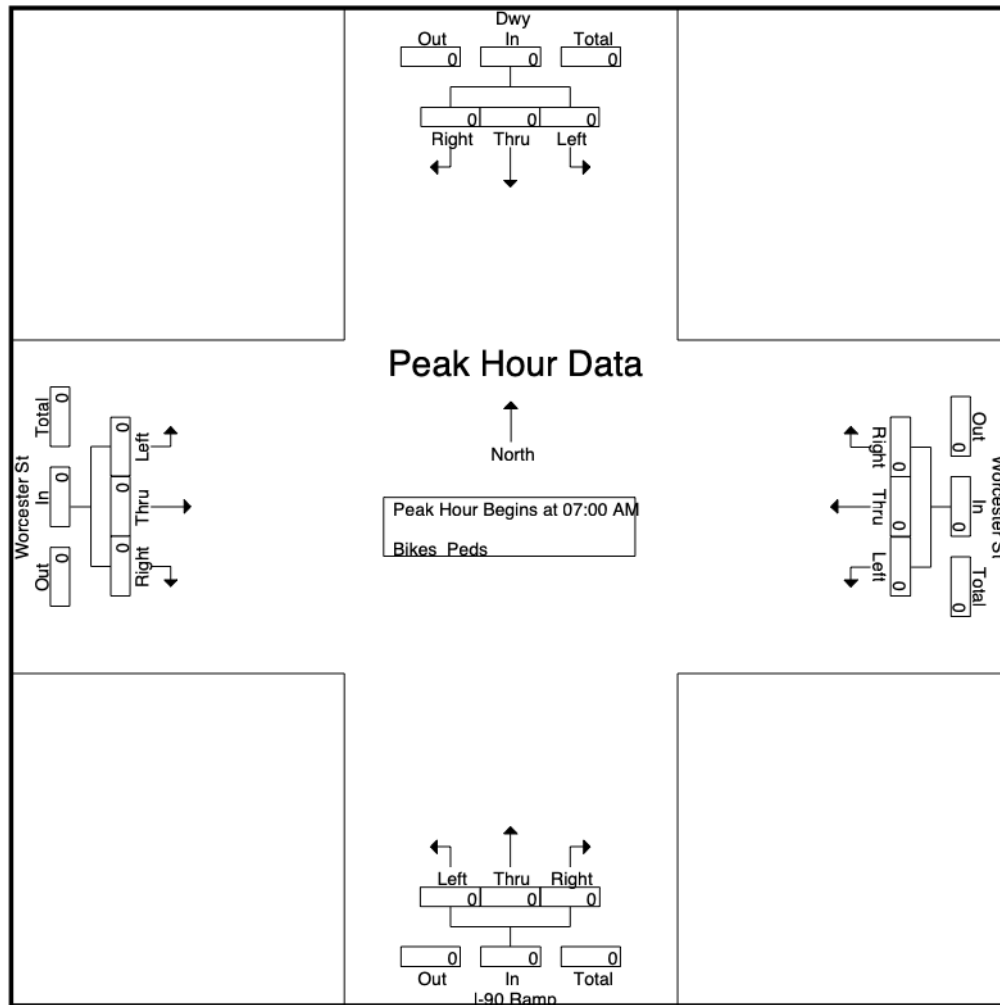
978-664-2565

File Name : 89150004  
Site Code : 89150004  
Start Date : 3/23/2021  
Page No : 10

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978-664-2565

File Name : 89150004  
Site Code : 89150004  
Start Date : 3/23/2021  
Page No : 11

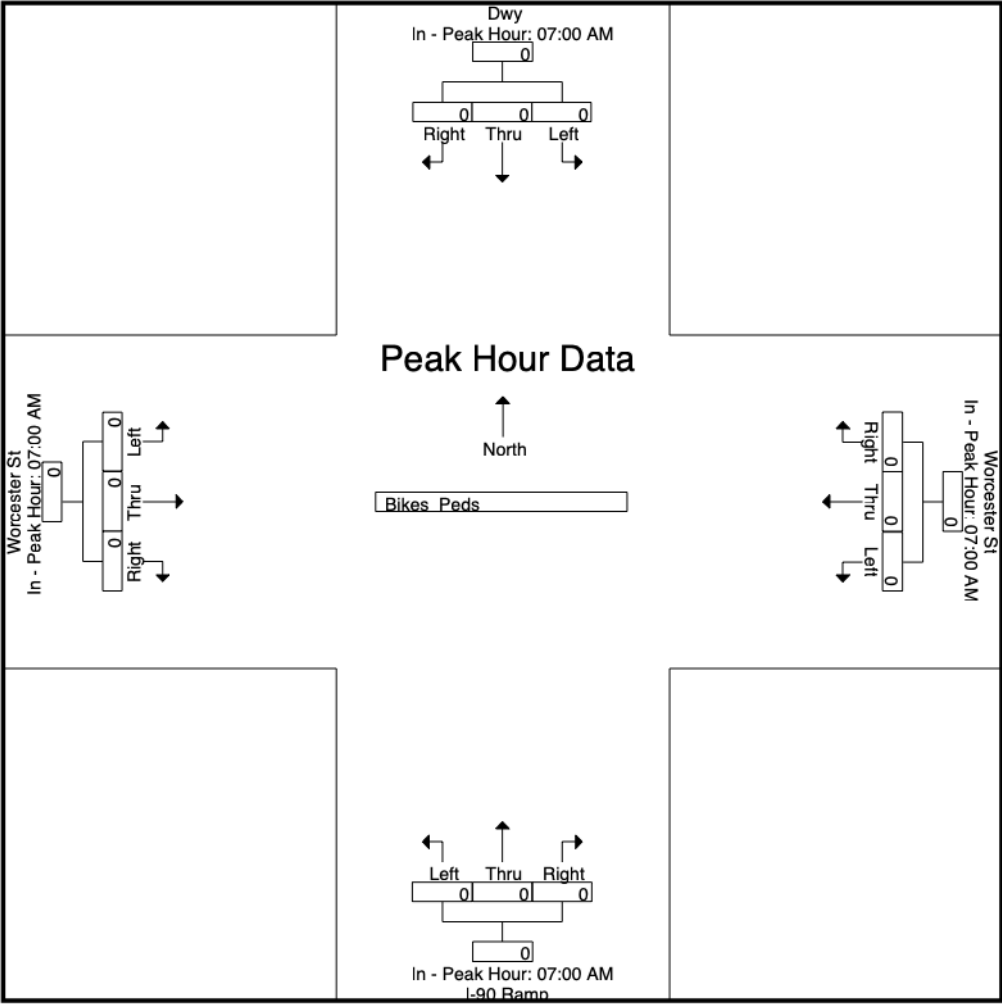


Peak Hour for Each Approach Begins at:

[illegible]

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150004  
Site Code : 89150004  
Start Date : 3/23/2021  
Page No : 12



# Accurate Counts

978-664-2565

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150004  
Site Code : 89150004  
Start Date : 3/23/2021  
Page No : 1

## Groups Printed- Cars - Trucks

	Dwy From North			Worcester St From East			I-90 Ramp From South			Worcester St From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
04:00 PM	0	0	0	77	84	0	108	1	63	0	105	71	509
04:15 PM	0	0	0	66	96	0	140	0	77	0	91	66	536
04:30 PM	0	0	0	59	80	0	86	0	80	0	102	71	478
04:45 PM	0	0	0	57	86	0	108	0	61	1	132	67	512
Total	0	0	0	259	346	0	442	1	281	1	430	275	2035
05:00 PM	0	0	0	63	88	0	110	1	70	0	101	68	501
05:15 PM	0	0	0	68	91	0	123	0	80	1	87	54	504
05:30 PM	0	0	0	47	78	0	93	0	83	0	97	59	457
05:45 PM	0	0	0	40	95	0	103	0	65	0	77	55	435
Total	0	0	0	218	352	0	429	1	298	1	362	236	1897
Grand Total	0	0	0	477	698	0	871	2	579	2	792	511	3932
Apprch %	0	0	0	40.6	59.4	0	60	0.1	39.9	0.2	60.7	39.2	
Total %	0	0	0	12.1	17.8	0	22.2	0.1	14.7	0.1	20.1	13	
Cars	0	0	0	464	693	0	823	2	570	2	790	474	3818
% Cars	0	0	0	97.3	99.3	0	94.5	100	98.4	100	99.7	92.8	97.1
Trucks	0	0	0	13	5	0	48	0	9	0	2	37	114
% Trucks	0	0	0	2.7	0.7	0	5.5	0	1.6	0	0.3	7.2	2.9

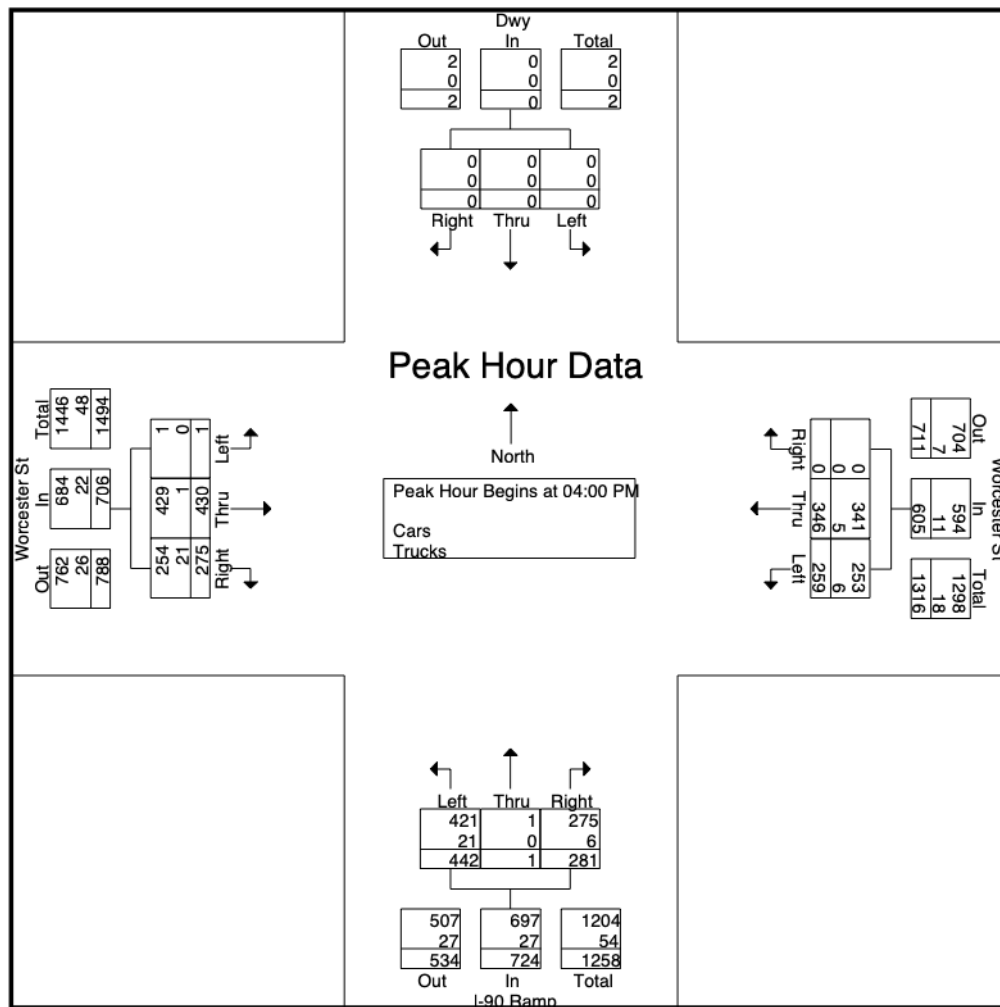
	Dwy From North				Worcester St From East				I-90 Ramp From South				Worcester St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	0	0	0	0	77	84	0	161	108	1	63	172	0	105	71	176	509
04:15 PM	0	0	0	0	66	96	0	162	140	0	77	217	0	91	66	157	536
04:30 PM	0	0	0	0	59	80	0	139	86	0	80	166	0	102	71	173	478
04:45 PM	0	0	0	0	57	86	0	143	108	0	61	169	1	132	67	200	512
Total Volume	0	0	0	0	259	346	0	605	442	1	281	724	1	430	275	706	2035
% App. Total	0	0	0	0	42.8	57.2	0		61	0.1	38.8		0.1	60.9	39		
PHF	.000	.000	.000	.000	.841	.901	.000	.934	.789	.250	.878	.834	.250	.814	.968	.883	.949
Cars	0	0	0	0	253	341	0	594	421	1	275	697	1	429	254	684	1975
% Cars	0	0	0	0	97.7	98.6	0	98.2	95.2	100	97.9	96.3	100	99.8	92.4	96.9	97.1
Trucks	0	0	0	0	6	5	0	11	21	0	6	27	0	1	21	22	60
% Trucks	0	0	0	0	2.3	1.4	0	1.8	4.8	0	2.1	3.7	0	0.2	7.6	3.1	2.9

# Accurate Counts

978-664-2565

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150004  
Site Code : 89150004  
Start Date : 3/23/2021  
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1  
Peak Hour for Each Approach Begins at:

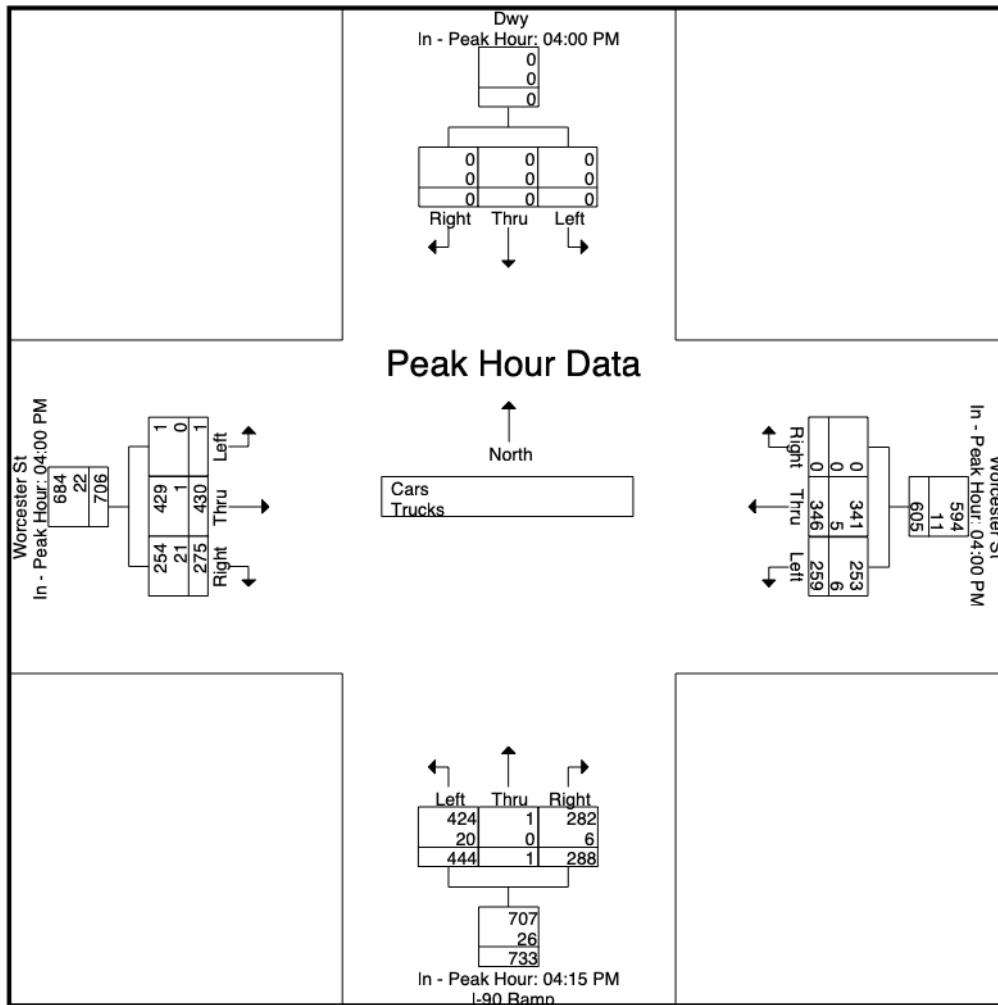
	04:00 PM				04:00 PM				04:15 PM				04:00 PM			
+0 mins.	0	0	0	0	77	84	0	161	140	0	77	217	0	105	71	176
+15 mins.	0	0	0	0	66	96	0	162	86	0	80	166	0	91	66	157
+30 mins.	0	0	0	0	59	80	0	139	108	0	61	169	0	102	71	173
+45 mins.	0	0	0	0	57	86	0	143	110	1	70	181	1	132	67	200
Total Volume	0	0	0	0	259	346	0	605	444	1	288	733	1	430	275	706
% App. Total	0	0	0	0	42.8	57.2	0		60.6	0.1	39.3		0.1	60.9	39	
PHF	.000	.000	.000	.000	.841	.901	.000	.934	.793	.250	.900	.844	.250	.814	.968	.883
Cars	0	0	0	0	253	341	0	594	424	1	282	707	1	429	254	684
% Cars	0	0	0	0	97.7	98.6	0	98.2	95.5	100	97.9	96.5	100	99.8	92.4	96.9
Trucks	0	0	0	0	6	5	0	11	20	0	6	26	0	1	21	22
% Trucks	0	0	0	0	2.3	1.4	0	1.8	4.5	0	2.1	3.5	0	0.2	7.6	3.1

# Accurate Counts

978-664-2565

N/S Street : Driveway / I-90 Ramps  
 E/W Street : Worcester Street  
 City/State : North Grafton, MA  
 Weather : Clear

File Name : 89150004  
 Site Code : 89150004  
 Start Date : 3/23/2021  
 Page No : 3



# Accurate Counts

978-664-2565

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150004  
Site Code : 89150004  
Start Date : 3/23/2021  
Page No : 4

## Groups Printed- Cars

	Dwy From North			Worcester St From East			I-90 Ramp From South			Worcester St From West			Int. Total
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
04:00 PM	0	0	0	76	82	0	102	1	62	0	104	65	492
04:15 PM	0	0	0	64	94	0	134	0	75	0	91	60	518
04:30 PM	0	0	0	58	80	0	81	0	78	0	102	65	464
04:45 PM	0	0	0	55	85	0	104	0	60	1	132	64	501
Total	0	0	0	253	341	0	421	1	275	1	429	254	1975
05:00 PM	0	0	0	62	88	0	105	1	69	0	101	64	490
05:15 PM	0	0	0	67	91	0	111	0	79	1	87	52	488
05:30 PM	0	0	0	45	78	0	87	0	83	0	97	56	446
05:45 PM	0	0	0	37	95	0	99	0	64	0	76	48	419
Total	0	0	0	211	352	0	402	1	295	1	361	220	1843
Grand Total	0	0	0	464	693	0	823	2	570	2	790	474	3818
Apprch %	0	0	0	40.1	59.9	0	59	0.1	40.9	0.2	62.4	37.4	
Total %	0	0	0	12.2	18.2	0	21.6	0.1	14.9	0.1	20.7	12.4	

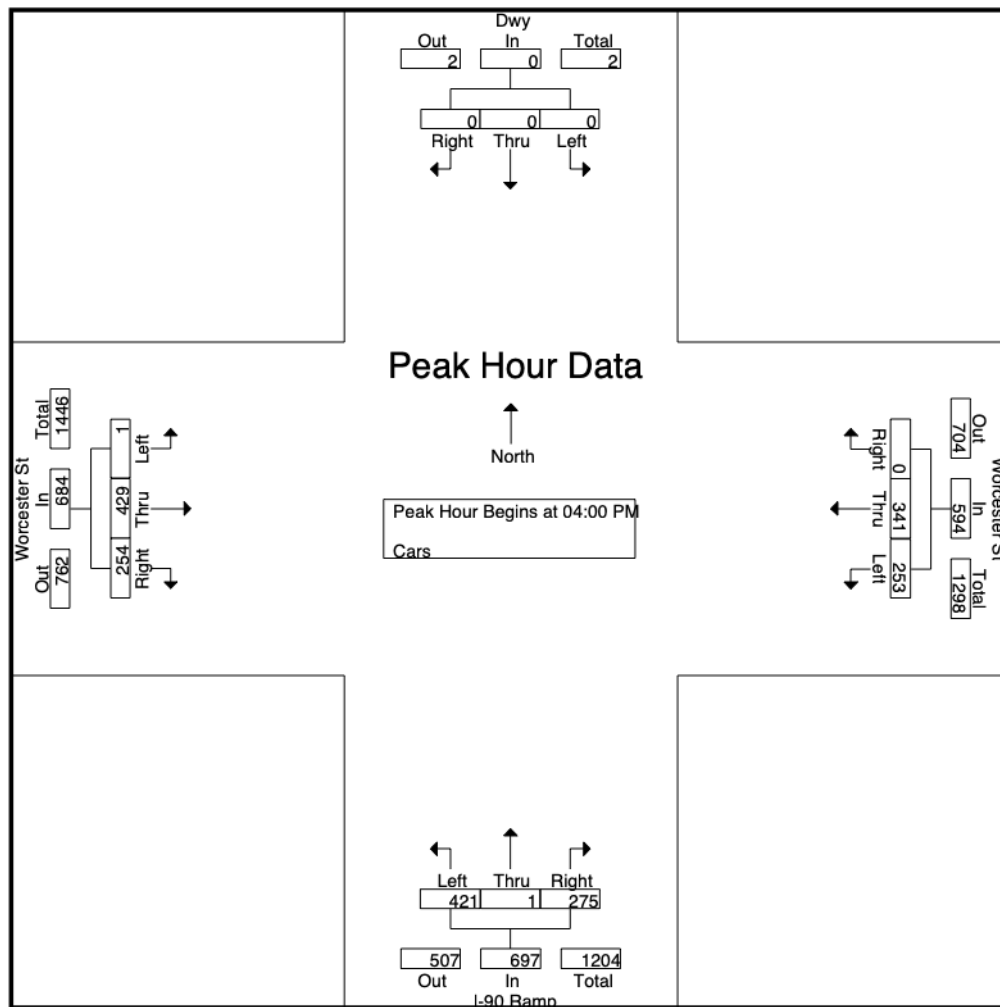
	Dwy From North				Worcester St From East				I-90 Ramp From South				Worcester St From West				Int. Total
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	0	0	0	0	76	82	0	158	102	1	62	165	0	104	65	169	492
04:15 PM	0	0	0	0	64	94	0	158	134	0	75	209	0	91	60	151	518
04:30 PM	0	0	0	0	58	80	0	138	81	0	78	159	0	102	65	167	464
04:45 PM	0	0	0	0	55	85	0	140	104	0	60	164	1	132	64	197	501
Total Volume	0	0	0	0	253	341	0	594	421	1	275	697	1	429	254	684	1975
% App. Total	0	0	0		42.6	57.4	0		60.4	0.1	39.5		0.1	62.7	37.1		
PHF	.000	.000	.000	.000	.832	.907	.000	.940	.785	.250	.881	.834	.250	.813	.977	.868	.953

# Accurate Counts

978-664-2565

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150004  
Site Code : 89150004  
Start Date : 3/23/2021  
Page No : 5

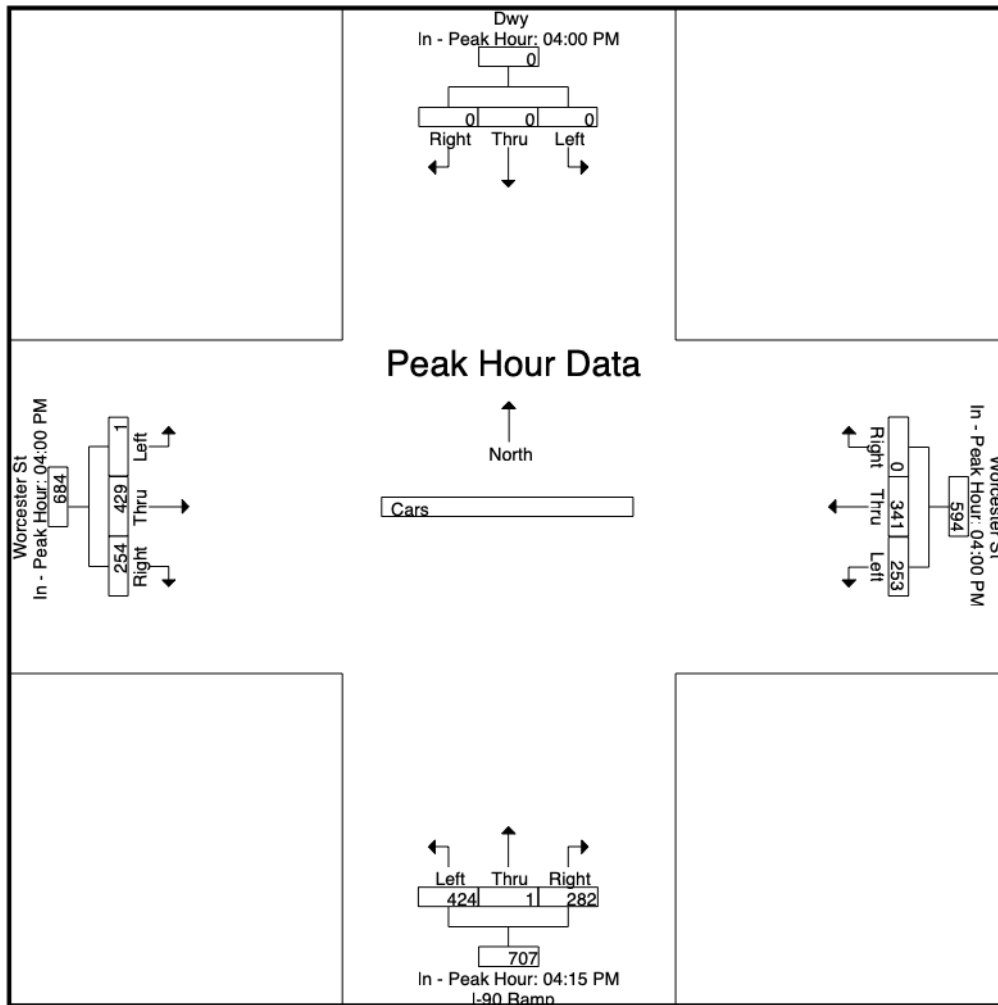


Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	04:00 PM				04:00 PM				04:15 PM				04:00 PM			
+0 mins.	0	0	0	0	<b>76</b>	82	0	<b>158</b>	<b>134</b>	0	75	<b>209</b>	0	104	<b>65</b>	169
+15 mins.	0	0	0	0	64	<b>94</b>	0	158	81	0	<b>78</b>	159	0	91	60	151
+30 mins.	0	0	0	0	58	80	0	138	104	0	60	164	0	102	65	167
+45 mins.	0	0	0	0	55	85	0	140	105	<b>1</b>	69	175	<b>1</b>	<b>132</b>	64	<b>197</b>
Total Volume	0	0	0	0	253	341	0	594	424	1	282	707	1	429	254	684
% App. Total	0	0	0	0	42.6	57.4	0		60	0.1	39.9		0.1	62.7	37.1	
PHF	.000	.000	.000	.000	.832	.907	.000	.940	.791	.250	.904	.846	.250	.813	.977	.868

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear



# Accurate Counts

978-664-2565

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150004  
Site Code : 89150004  
Start Date : 3/23/2021  
Page No : 7

## Groups Printed- Trucks

	Dwy From North			Worcester St From East			I-90 Ramp From South			Worcester St From West			Int. Total
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
04:00 PM	0	0	0	1	2	0	6	0	1	0	1	6	17
04:15 PM	0	0	0	2	2	0	6	0	2	0	0	6	18
04:30 PM	0	0	0	1	0	0	5	0	2	0	0	6	14
04:45 PM	0	0	0	2	1	0	4	0	1	0	0	3	11
Total	0	0	0	6	5	0	21	0	6	0	1	21	60
05:00 PM	0	0	0	1	0	0	5	0	1	0	0	4	11
05:15 PM	0	0	0	1	0	0	12	0	1	0	0	2	16
05:30 PM	0	0	0	2	0	0	6	0	0	0	0	3	11
05:45 PM	0	0	0	3	0	0	4	0	1	0	1	7	16
Total	0	0	0	7	0	0	27	0	3	0	1	16	54
Grand Total	0	0	0	13	5	0	48	0	9	0	2	37	114
Apprch %	0	0	0	72.2	27.8	0	84.2	0	15.8	0	5.1	94.9	
Total %	0	0	0	11.4	4.4	0	42.1	0	7.9	0	1.8	32.5	

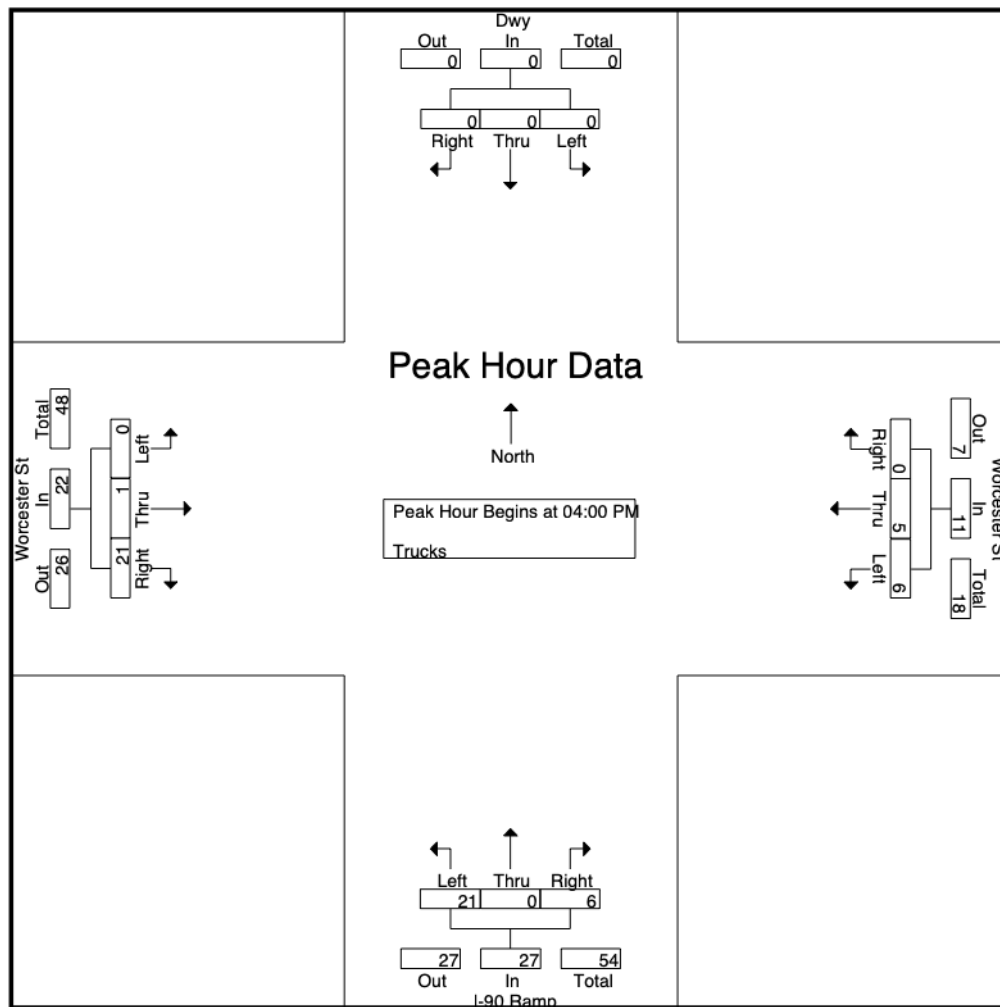
	Dwy From North				Worcester St From East				I-90 Ramp From South				Worcester St From West				Int. Total
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	0	0	0	0	1	2	0	3	6	0	1	7	0	1	6	7	17
04:15 PM	0	0	0	0	2	2	0	4	6	0	2	8	0	0	6	6	18
04:30 PM	0	0	0	0	1	0	0	1	5	0	2	7	0	0	6	6	14
04:45 PM	0	0	0	0	2	1	0	3	4	0	1	5	0	0	3	3	11
Total Volume	0	0	0	0	6	5	0	11	21	0	6	27	0	1	21	22	60
% App. Total	0	0	0		54.5	45.5	0		77.8	0	22.2		0	4.5	95.5		
PHF	.000	.000	.000	.000	.750	.625	.000	.688	.875	.000	.750	.844	.000	.250	.875	.786	.833

# Accurate Counts

978-664-2565

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150004  
Site Code : 89150004  
Start Date : 3/23/2021  
Page No : 8

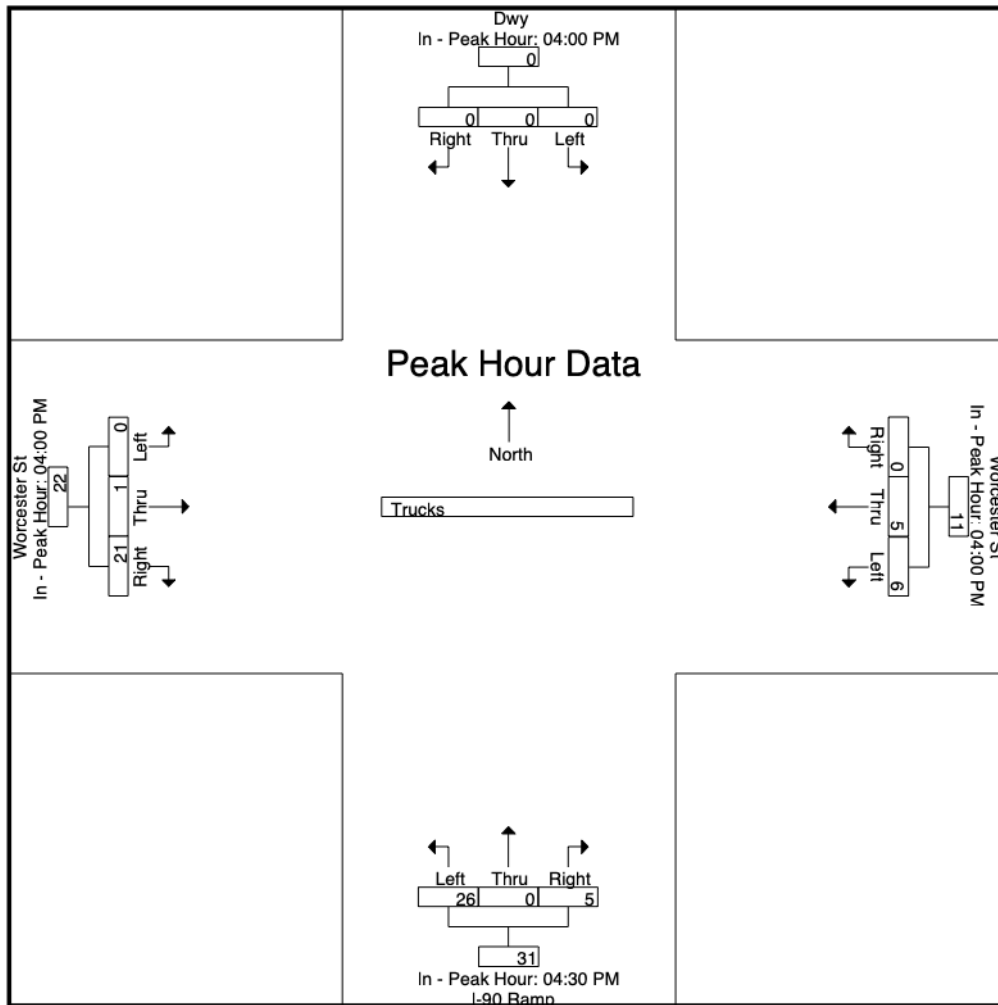


Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	04:00 PM				04:00 PM				04:30 PM				04:00 PM			
+0 mins.	0	0	0	0	1	2	0	3	5	0	2	7	0	1	6	7
+15 mins.	0	0	0	0	2	2	0	4	4	0	1	5	0	0	6	6
+30 mins.	0	0	0	0	1	0	0	1	5	0	1	6	0	0	6	6
+45 mins.	0	0	0	0	2	1	0	3	12	0	1	13	0	0	3	3
Total Volume	0	0	0	0	6	5	0	11	26	0	5	31	0	1	21	22
% App. Total	0	0	0	0	54.5	45.5	0		83.9	0	16.1		0	4.5	95.5	
PHF	.000	.000	.000	.000	.750	.625	.000	.688	.542	.000	.625	.596	.000	.250	.875	.786

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear



# Accurate Counts

978-664-2565

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

File Name : 89150004  
Site Code : 89150004  
Start Date : 3/23/2021  
Page No : 10

## Groups Printed- Bikes Peds

	Dwy From North				Worcester St From East				I-90 Ramp From South				Worcester St From West				Exclu. Total	Inclu. Total	Int. Total
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds			
04:00 PM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	3	3
Total	0	0	0	0	0	2	0	0	0	0	0	0	0	3	0	0	0	5	5
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
05:15 PM	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	2
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1
Total	0	0	0	1	0	1	0	0	0	0	0	1	0	1	0	0	2	2	4
Grand Total	0	0	0	1	0	3	0	0	0	0	0	1	0	4	0	0	2	7	9
Apprch %	0	0	0		0	100	0		0	0	0		0	100	0				
Total %	0	0	0		0	42.9	0		0	0	0		0	57.1	0		22.2	77.8	

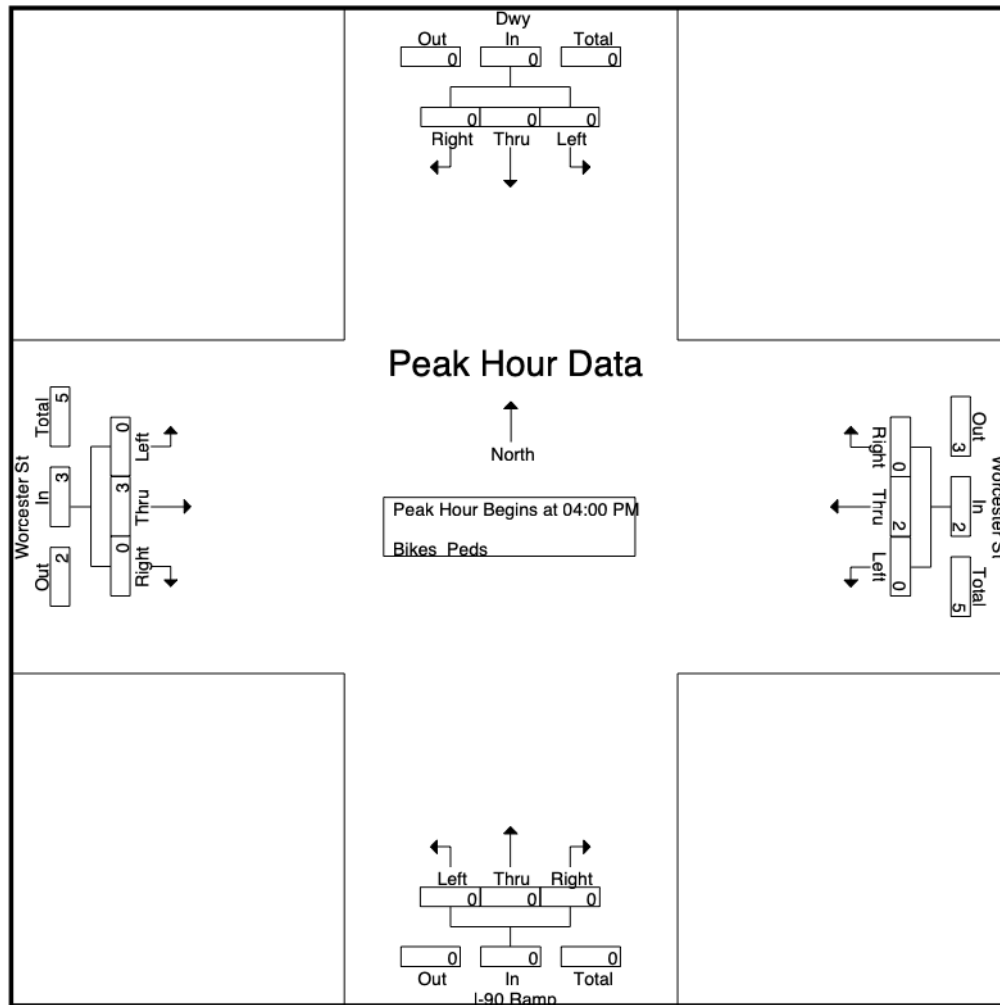
	Dwy From North				Worcester St From East				I-90 Ramp From South				Worcester St From West						
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total		
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																			
Peak Hour for Entire Intersection Begins at 04:00 PM																			
04:00 PM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	1
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	1	0	1	0	0	0	0	0	2	0	2	3	3	3
Total Volume	0	0	0	0	0	2	0	2	0	0	0	0	0	3	0	3	5	5	5
% App. Total	0	0	0		0	100	0		0	0	0		0	100	0				
PHF	.000	.000	.000	.000	.000	.500	.000	.500	.000	.000	.000	.000	.000	.375	.000	.375	.417		

# Accurate Counts

978-664-2565

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear

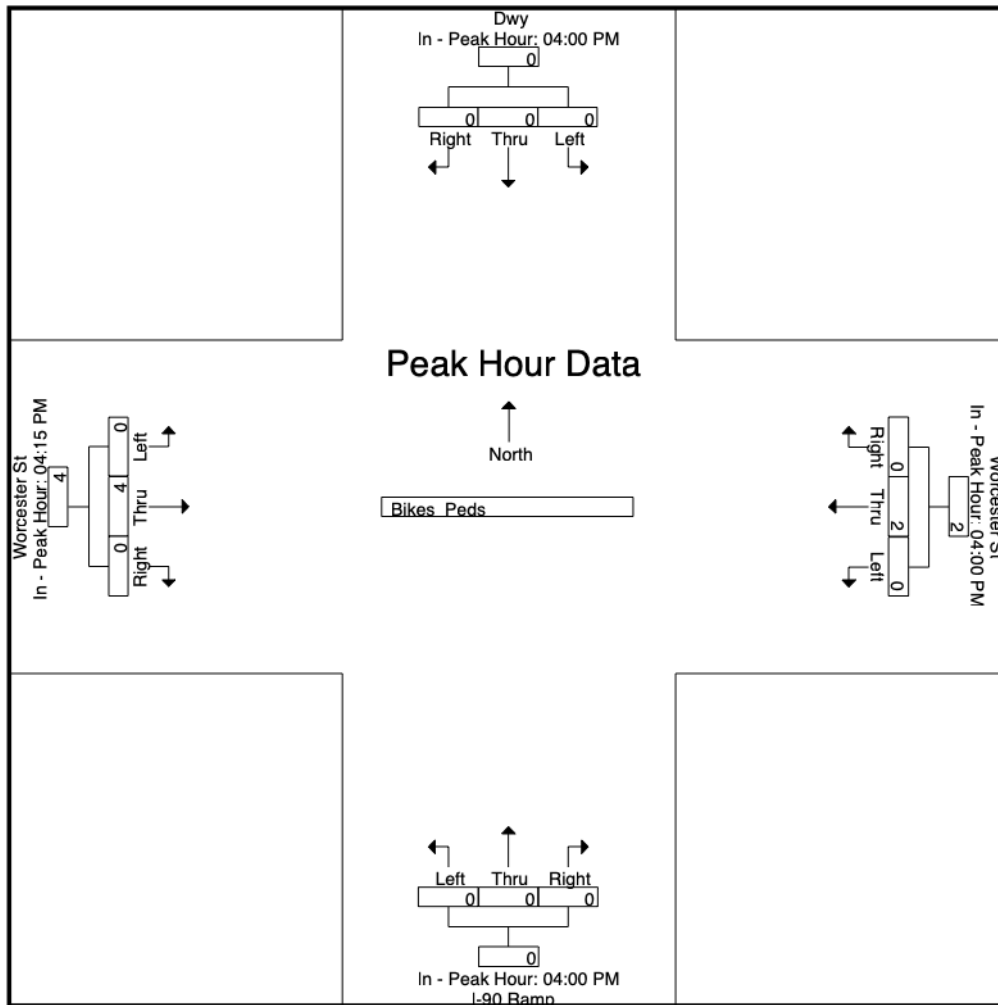
File Name : 89150004  
Site Code : 89150004  
Start Date : 3/23/2021  
Page No : 11



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1  
Peak Hour for Each Approach Begins at:

	04:00 PM				04:00 PM				04:00 PM				04:15 PM			
+0 mins.	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1
+15 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
+45 mins.	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1
Total Volume	0	0	0	0	0	2	0	2	0	0	0	0	0	4	0	4
% App. Total	0	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0
PHF	.000	.000	.000	.000	.000	.500	.000	.500	.000	.000	.000	.000	.000	.500	.000	.500

N/S Street : Driveway / I-90 Ramps  
E/W Street : Worcester Street  
City/State : North Grafton, MA  
Weather : Clear



AUTOMATIC TRAFFIC RECORDER

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**Accurate Counts**  
978-664-2565

Page 1

Location : Worcester Street  
Location : East of Hilltop Street  
City/State: North Grafton, MA

8915VL01

Start Time	3/23/2021 Tue	WB		Hour Totals		EB		Hour Totals		Combined Totals	
		Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		9	119			10	117				
12:15		8	109			9	121				
12:30		5	104			6	145				
12:45		6	112	28	444	1	116	26	499	54	943
01:00		6	98			4	120				
01:15		5	103			5	128				
01:30		3	122			2	131				
01:45		6	126	20	449	2	127	13	506	33	955
02:00		4	139			3	118				
02:15		7	141			6	126				
02:30		8	109			4	125				
02:45		10	117	29	506	9	146	22	515	51	1021
03:00		3	147			3	142				
03:15		4	160			7	145				
03:30		7	144			7	173				
03:45		7	160	21	611	6	188	23	648	44	1259
04:00		10	154			5	182				
04:15		10	165			13	173				
04:30		15	123			19	192				
04:45		36	139	71	581	17	215	54	762	125	1343
05:00		32	142			14	169				
05:15		41	148			23	175				
05:30		52	135			45	176				
05:45		53	125	178	550	53	150	135	670	313	1220
06:00		76	113			50	120				
06:15		91	118			54	111				
06:30		102	101			88	102				
06:45		112	81	381	413	95	103	287	436	668	849
07:00		112	76			107	99				
07:15		153	65			87	85				
07:30		150	52			120	82				
07:45		123	67	538	260	119	69	433	335	971	595
08:00		130	53			121	48				
08:15		137	41			101	55				
08:30		101	53			94	64				
08:45		112	34	480	181	124	41	440	208	920	389
09:00		107	36			89	49				
09:15		107	23			91	38				
09:30		102	25			91	40				
09:45		101	27	417	111	84	38	355	165	772	276
10:00		91	43			74	23				
10:15		103	20			81	21				
10:30		102	21			79	30				
10:45		91	12	387	96	97	25	331	99	718	195
11:00		85	11			99	22				
11:15		78	13			86	16				
11:30		74	8			108	20				
11:45		106	11	343	43	120	9	413	67	756	110
Total		2893	4245			2532	4910			5425	9155
Percent		40.5%	59.5%			34.0%	66.0%			37.2%	62.8%

**Accurate Counts**  
978-664-2565

Page 2

Location : Worcester Street  
Location : East of Hilltop Street  
City/State: North Grafton, MA

8915VL01

Start Time	3/24/2021 Wed	WB		Hour Totals		EB		Hour Totals		Combined Totals	
		Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		7	107			15	114				
12:15		5	114			9	98				
12:30		7	123			9	101				
12:45		7	125	26	469	8	113	41	426	67	895
01:00		11	86			3	117				
01:15		4	82			4	101				
01:30		3	116			8	125				
01:45		1	112	19	396	4	119	19	462	38	858
02:00		10	141			2	103				
02:15		4	147			5	112				
02:30		4	111			8	126				
02:45		5	134	23	533	5	136	20	477	43	1010
03:00		5	135			3	141				
03:15		3	129			4	170				
03:30		15	148			7	150				
03:45		9	141	32	553	3	158	17	619	49	1172
04:00		9	141			6	170				
04:15		15	157			10	167				
04:30		14	137			18	167				
04:45		23	140	61	575	15	179	49	683	110	1258
05:00		30	140			17	164				
05:15		30	134			27	166				
05:30		41	133			57	151				
05:45		58	108	159	515	51	150	152	631	311	1146
06:00		62	105			48	121				
06:15		88	114			49	116				
06:30		103	97			98	83				
06:45		108	56	361	372	96	95	291	415	652	787
07:00		107	58			107	80				
07:15		134	82			100	81				
07:30		142	64			116	70				
07:45		145	51	528	255	121	72	444	303	972	558
08:00		111	50			102	56				
08:15		119	33			91	62				
08:30		115	55			91	57				
08:45		114	41	459	179	113	38	397	213	856	392
09:00		115	28			82	27				
09:15		101	34			86	35				
09:30		111	32			80	36				
09:45		91	18	418	112	81	36	329	134	747	246
10:00		119	35			93	22				
10:15		101	32			79	23				
10:30		87	21			80	23				
10:45		91	16	398	104	94	26	346	94	744	198
11:00		107	22			108	13				
11:15		105	11			108	19				
11:30		110	8			88	18				
11:45		117	10	439	51	99	14	403	64	842	115
Total		2923	4114			2508	4521			5431	8635
Percent		41.5%	58.5%			35.7%	64.3%			38.6%	61.4%
Grand Total		5816	8359			5040	9431			10856	17790
Percent		41.0%	59.0%			34.8%	65.2%			37.9%	62.1%
ADT	ADT 14,323		AADT 14,323								

Location : Worcester Street  
Location : East of Hilltop Street  
City/State: North Grafton, MA

8915VL01

Start Time	3/22/2021		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB
12:00 AM	*	*	28	26	26	41	*	*	*	*	*	*	*	*	27	34
01:00	*	*	20	13	19	19	*	*	*	*	*	*	*	*	20	16
02:00	*	*	29	22	23	20	*	*	*	*	*	*	*	*	26	21
03:00	*	*	21	23	32	17	*	*	*	*	*	*	*	*	26	20
04:00	*	*	71	54	61	49	*	*	*	*	*	*	*	*	66	52
05:00	*	*	178	135	159	152	*	*	*	*	*	*	*	*	168	144
06:00	*	*	381	287	361	291	*	*	*	*	*	*	*	*	371	289
07:00	*	*	538	433	528	444	*	*	*	*	*	*	*	*	533	438
08:00	*	*	480	440	459	397	*	*	*	*	*	*	*	*	470	418
09:00	*	*	417	355	418	329	*	*	*	*	*	*	*	*	418	342
10:00	*	*	387	331	398	346	*	*	*	*	*	*	*	*	392	338
11:00	*	*	343	413	439	403	*	*	*	*	*	*	*	*	391	408
12:00 PM	*	*	444	499	469	426	*	*	*	*	*	*	*	*	456	462
01:00	*	*	449	506	396	462	*	*	*	*	*	*	*	*	422	484
02:00	*	*	506	515	533	477	*	*	*	*	*	*	*	*	520	496
03:00	*	*	611	648	553	619	*	*	*	*	*	*	*	*	582	634
04:00	*	*	581	762	575	683	*	*	*	*	*	*	*	*	578	722
05:00	*	*	550	670	515	631	*	*	*	*	*	*	*	*	532	650
06:00	*	*	413	436	372	415	*	*	*	*	*	*	*	*	392	426
07:00	*	*	260	335	255	303	*	*	*	*	*	*	*	*	258	319
08:00	*	*	181	208	179	213	*	*	*	*	*	*	*	*	180	210
09:00	*	*	111	165	112	134	*	*	*	*	*	*	*	*	112	150
10:00	*	*	96	99	104	94	*	*	*	*	*	*	*	*	100	96
11:00	*	*	43	67	51	64	*	*	*	*	*	*	*	*	47	66
Lane	0	0	7138	7442	7037	7029	0	0	0	0	0	0	0	0	7087	7235
Day	0	0	14580		14066		0	0	0	0	0	0	0	0	14322	
AM Peak	-	-	07:00	08:00	07:00	07:00	-	-	-	-	-	-	-	-	07:00	07:00
Vol.	-	-	538	440	528	444	-	-	-	-	-	-	-	-	533	438
PM Peak	-	-	15:00	16:00	16:00	16:00	-	-	-	-	-	-	-	-	15:00	16:00
Vol.	-	-	611	762	575	683	-	-	-	-	-	-	-	-	582	722

Comb. Total 0 14580 14066 0 0 0 14322

ADT ADT 14,323 AADT 14,323

## VEHICLE TRAVEL SPEED MEASUREMENTS

**Accurate Counts**  
978-664-2565

8915SP01

Location : Worcester Street  
Location : East of Hilltop Street  
City/State: North Grafton, MA

**WB**

Start Time	15	16	20	21	25	26	30	31	35	36	40	41	45	46	50	51	55	56	60	61	65	66	70	71	75	76	Total
03/23/21	0	0	0	0	0	5	5	7	7	6	6	6	6	2	2	1	1	1	1	0	0	0	0	0	0	0	28
01:00	0	0	0	0	0	1	1	8	8	2	2	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0	20
02:00	0	0	0	2	2	2	2	6	6	13	13	2	2	4	4	0	0	0	0	0	0	0	0	0	0	0	29
03:00	0	0	0	0	0	4	4	2	2	10	10	1	1	3	3	1	1	0	0	0	0	0	0	0	0	0	21
04:00	0	0	0	3	3	2	2	20	20	19	19	20	20	5	5	2	2	0	0	0	0	0	0	0	0	0	71
05:00	0	0	0	0	0	7	7	46	46	72	72	43	43	10	10	0	0	0	0	0	0	0	0	0	0	0	178
06:00	1	0	0	5	5	15	15	95	95	173	173	76	76	15	15	1	1	0	0	0	0	0	0	0	0	0	381
07:00	0	0	0	3	3	18	18	114	114	260	260	132	132	11	11	0	0	0	0	0	0	0	0	0	0	0	538
08:00	0	0	0	0	0	13	13	106	106	204	204	132	132	21	21	4	4	0	0	0	0	0	0	0	0	0	480
09:00	0	0	0	5	5	7	7	75	75	189	189	124	124	17	17	0	0	0	0	0	0	0	0	0	0	0	417
10:00	0	0	0	7	7	18	18	114	114	160	160	76	76	10	10	2	2	0	0	0	0	0	0	0	0	0	387
11:00	0	0	3	4	4	17	17	67	67	150	150	85	85	17	17	0	0	0	0	0	0	0	0	0	0	0	343
12 PM	2	1	7	7	7	10	10	72	72	216	216	102	102	32	32	2	2	0	0	0	0	0	0	0	0	0	444
13:00	0	1	13	6	6	19	19	75	75	198	198	120	120	22	22	7	7	0	0	0	1	0	0	0	0	0	449
14:00	0	1	1	1	1	29	29	112	112	229	229	102	102	29	29	3	3	0	0	0	0	0	0	0	0	0	506
15:00	1	0	0	13	13	11	11	111	111	306	306	135	135	31	31	3	3	0	0	0	0	0	0	0	0	0	611
16:00	0	2	0	0	0	21	21	100	100	264	264	165	165	27	27	1	1	0	0	0	0	0	0	0	0	0	581
17:00	0	0	0	0	0	17	17	92	92	244	244	164	164	31	31	2	2	0	0	0	0	0	0	0	0	0	550
18:00	0	0	0	3	3	13	13	82	82	169	169	109	109	32	32	3	3	0	0	0	0	0	0	0	0	0	413
19:00	0	1	0	0	0	13	13	55	55	114	114	63	63	12	12	2	2	0	0	0	0	0	0	0	0	0	260
20:00	1	0	0	0	0	1	1	21	21	80	80	61	61	17	17	0	0	0	0	0	0	0	0	0	0	0	181
21:00	0	0	0	1	1	4	4	15	15	40	40	36	36	12	12	2	2	1	1	0	0	0	0	0	0	0	111
22:00	0	0	0	1	1	11	11	21	21	30	30	22	22	11	11	0	0	0	0	0	0	0	0	0	0	0	96
23:00	0	0	0	0	0	1	1	7	7	19	19	9	9	5	5	0	0	0	0	0	1	0	0	0	0	0	43
Total	5	9	61	259	1423	3167	1793	376	37	5	2	1	43	0	0	0	0	1	5	2	2	0	0	0	0	1	7138

Daily

15th Percentile : 32 MPH  
50th Percentile : 37 MPH  
85th Percentile : 43 MPH  
95th Percentile : 45 MPH

Mean Speed(Average) : 38 MPH  
10 MPH Pace Speed : 36-45 MPH  
Number in Pace : 4960  
Percent in Pace : 69.5%  
Number of Vehicles > 35 MPH : 5381  
Percent of Vehicles > 35 MPH : 75.4%

# Accurate Counts 978-664-2565

8915SP01

Location : Worcester Street  
Location : East of Hilltop Street  
City/State: North Grafton, MA

WB

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total
03/24/21	0	0	0	3	6	7	6	3	0	1	0	0	0	0	26
01:00	0	0	1	0	5	4	8	1	0	0	0	0	0	0	19
02:00	0	0	0	2	8	8	5	0	0	0	0	0	0	0	23
03:00	0	0	0	3	5	14	7	1	1	0	1	0	0	0	32
04:00	0	0	0	3	14	21	16	7	0	0	0	0	0	0	61
05:00	0	0	0	5	37	57	46	9	4	1	0	0	0	0	159
06:00	0	0	3	8	72	172	74	30	2	0	0	0	0	0	361
07:00	0	0	3	12	101	278	115	19	0	0	0	0	0	0	528
08:00	0	0	4	21	94	197	123	19	1	0	0	0	0	0	459
09:00	0	4	2	30	89	177	99	17	0	0	0	0	0	0	418
10:00	0	0	2	7	59	199	110	20	1	0	0	0	0	0	398
11:00	0	2	6	16	104	173	118	18	2	0	0	0	0	0	439
12 PM	0	0	0	16	115	191	119	28	0	0	0	0	0	0	469
13:00	2	0	6	28	134	150	71	5	0	0	0	0	0	0	396
14:00	0	7	5	28	116	245	112	18	2	0	0	0	0	0	533
15:00	0	0	2	14	115	259	137	22	4	0	0	0	0	0	553
16:00	0	1	2	10	110	265	159	27	1	0	0	0	0	0	575
17:00	0	0	1	13	104	235	144	15	2	1	0	0	0	0	515
18:00	0	1	4	12	72	147	110	23	3	0	0	0	0	0	372
19:00	0	0	0	6	52	117	66	11	2	0	0	0	0	0	255
20:00	0	0	0	7	27	72	56	17	0	0	0	0	0	0	179
21:00	0	0	0	4	22	34	43	5	4	0	0	0	0	0	112
22:00	0	0	1	7	32	24	31	7	2	0	0	0	0	0	104
23:00	0	0	0	3	5	17	13	11	2	0	0	0	0	0	51
Total	2	15	42	258	1498	3063	1788	333	33	4	1	0	0	0	7037

Daily

15th Percentile : 32 MPH  
50th Percentile : 37 MPH  
85th Percentile : 43 MPH  
95th Percentile : 45 MPH

Mean Speed(Average) : 38 MPH  
10 MPH Pace Speed : 36-45 MPH  
Number in Pace : 4851  
Percent in Pace : 68.9%  
Number of Vehicles > 35 MPH : 5222  
Percent of Vehicles > 35 MPH : 74.2%

Grand Total	7	24	103	517	2921	6230	3581	709	70	9	3	0	0	1	14175
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Overall

15th Percentile : 32 MPH  
50th Percentile : 37 MPH  
85th Percentile : 43 MPH  
95th Percentile : 45 MPH

Mean Speed(Average) : 38 MPH  
10 MPH Pace Speed : 36-45 MPH  
Number in Pace : 9811  
Percent in Pace : 69.2%  
Number of Vehicles > 35 MPH : 10603  
Percent of Vehicles > 35 MPH : 74.8%

# Accurate Counts 978-664-2565

8915SP01

Location : Worcester Street  
Location : East of Hilltop Street  
City/State: North Grafton, MA

EB

Start Time	15	16	20	21	25	26	30	31	35	36	40	41	45	46	50	51	55	56	60	61	65	66	70	71	75	76	Total
03/23/21	0	0	0	0	0	4	4	5	5	12	12	3	3	0	0	2	2	0	0	0	0	0	0	0	0	0	26
01:00	0	0	0	0	0	0	0	3	3	4	4	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	13
02:00	0	0	0	0	0	3	3	2	2	11	11	4	4	2	2	0	0	0	0	0	0	0	0	0	0	0	22
03:00	0	0	0	0	0	3	3	6	6	9	9	3	3	1	1	0	0	0	0	0	0	0	0	0	0	0	23
04:00	0	1	0	0	0	3	3	15	15	16	16	15	15	4	4	0	0	0	0	0	0	0	0	0	0	0	54
05:00	0	0	0	0	0	11	11	33	33	53	53	35	35	3	3	0	0	0	0	0	0	0	0	0	0	0	135
06:00	0	0	0	1	1	12	12	70	70	138	138	57	57	8	8	1	1	0	0	0	0	0	0	0	0	0	287
07:00	1	5	10	10	10	26	26	109	109	190	190	82	82	10	10	0	0	0	0	0	0	0	0	0	0	0	433
08:00	0	3	11	11	11	28	28	133	133	164	164	80	80	21	21	0	0	0	0	0	0	0	0	0	0	0	440
09:00	1	1	8	8	8	19	19	94	94	150	150	71	71	9	9	2	2	0	0	0	0	0	0	0	0	0	355
10:00	2	0	6	6	6	42	42	117	117	125	125	34	34	5	5	0	0	0	0	0	0	0	0	0	0	0	331
11:00	0	1	17	17	17	35	35	144	144	143	143	66	66	5	5	1	1	0	0	0	0	0	0	0	0	0	413
12 PM	0	10	13	13	13	67	67	179	179	153	153	62	62	15	15	0	0	0	0	0	0	0	0	0	0	0	499
13:00	2	5	14	14	14	71	71	148	148	181	181	77	77	8	8	0	0	0	0	0	0	0	0	0	0	0	506
14:00	0	1	8	8	8	64	64	159	159	192	192	85	85	6	6	0	0	0	0	0	0	0	0	0	0	0	515
15:00	0	0	29	29	29	103	103	208	208	208	208	86	86	13	13	0	0	0	0	0	0	0	0	0	0	0	648
16:00	0	0	19	19	19	93	93	245	245	270	270	120	120	14	14	1	1	0	0	0	0	0	0	0	0	0	762
17:00	0	0	2	2	2	47	47	193	193	313	313	100	100	13	13	2	2	0	0	0	0	0	0	0	0	0	670
18:00	0	0	0	0	0	21	21	131	131	192	192	78	78	13	13	1	1	0	0	0	0	0	0	0	0	0	436
19:00	4	5	3	3	3	31	31	106	106	141	141	35	35	7	7	3	3	0	0	0	0	0	0	0	0	0	335
20:00	0	0	0	0	0	19	19	52	52	90	90	39	39	5	5	0	0	0	0	0	0	0	0	0	0	0	208
21:00	0	0	0	0	0	7	7	42	42	71	71	39	39	6	6	0	0	0	0	0	0	0	0	0	0	0	165
22:00	0	0	0	1	1	4	4	21	21	53	53	16	16	4	4	0	0	0	0	0	0	0	0	0	0	0	99
23:00	0	0	0	0	0	0	0	16	16	22	22	27	27	1	1	0	0	1	1	0	0	0	0	0	0	0	67
Total	10	32	146	146	146	713	713	2231	2231	2901	2901	1220	1220	173	173	13	13	3	3	0	0	0	0	0	0	0	7442

Daily

15th Percentile : 30 MPH  
50th Percentile : 36 MPH  
85th Percentile : 41 MPH  
95th Percentile : 44 MPH

Mean Speed(Average) : 36 MPH  
10 MPH Pace Speed : 31-40 MPH  
Number in Pace : 5132  
Percent in Pace : 69.0%  
Number of Vehicles > 35 MPH : 4310  
Percent of Vehicles > 35 MPH : 57.9%



**Accurate Counts**  
978-664-2565

8915SP01

Location : Worcester Street  
Location : East of Hilltop Street  
City/State: North Grafton, MA

**WB, EB**

Start Time	15	16	21	26	31	36	41	46	51	56	61	66	71	76	Total
Time	15	20	25	30	35	40	45	50	55	60	65	70	75	999	Total
03/23/21	0	0	0	9	12	18	9	2	3	1	0	0	0	0	54
01:00	0	0	0	1	11	6	14	0	1	0	0	0	0	0	33
02:00	0	0	2	5	8	24	6	6	0	0	0	0	0	0	51
03:00	0	0	1	7	8	19	4	4	1	0	0	0	0	0	44
04:00	0	1	3	5	35	35	35	9	2	0	0	0	0	0	125
05:00	0	0	0	18	79	125	78	13	0	0	0	0	0	0	313
06:00	1	0	6	27	165	311	133	23	2	0	0	0	0	0	668
07:00	1	5	13	44	223	450	214	21	0	0	0	0	0	0	971
08:00	0	3	11	41	239	368	212	42	4	0	0	0	0	0	920
09:00	1	1	13	26	169	339	195	26	2	0	0	0	0	0	772
10:00	2	0	13	60	231	285	110	15	2	0	0	0	0	0	718
11:00	0	4	21	52	211	293	151	22	1	1	0	0	0	0	756
12 PM	2	11	20	77	251	369	164	47	2	0	0	0	0	0	943
13:00	2	6	20	90	223	379	197	30	7	0	1	0	0	0	955
14:00	0	2	9	93	271	421	187	35	3	0	0	0	0	0	1021
15:00	1	0	42	114	319	514	221	44	3	1	0	0	0	0	1259
16:00	0	2	19	114	345	534	285	41	2	1	0	0	0	0	1343
17:00	0	0	2	64	285	557	264	44	4	0	0	0	0	0	1220
18:00	0	0	3	34	213	361	187	45	4	2	0	0	0	0	849
19:00	4	6	3	44	161	255	98	19	5	0	0	0	0	0	595
20:00	1	0	3	20	73	170	100	22	0	0	0	0	0	0	389
21:00	0	0	1	11	57	111	75	18	2	1	0	0	0	0	276
22:00	0	0	2	15	42	83	38	15	0	0	0	0	0	0	195
23:00	0	0	0	1	23	41	36	6	1	1	1	0	0	1	110
Total	15	41	207	972	3654	6088	3013	549	50	8	2	0	0	1	14580

Daily

15th Percentile : 31 MPH  
50th Percentile : 36 MPH  
85th Percentile : 42 MPH  
95th Percentile : 44 MPH

Mean Speed(Average) : 37 MPH  
10 MPH Pace Speed : 31-40 MPH  
Number in Pace : 9722  
Percent in Pace : 66.7%  
Number of Vehicles > 35 MPH : 9691  
Percent of Vehicles > 35 MPH : 66.5%

# Accurate Counts 978-664-2565

8915SP01

Location : Worcester Street  
Location : East of Hilltop Street  
City/State: North Grafton, MA

WB, EB

Start Time	15	16	20	21	25	26	30	31	35	36	40	41	45	46	50	51	55	56	60	61	65	66	70	71	75	76	Total
03/24/21	0	0	0	0	0	6	15	31	40	36	41	45	50	51	55	56	60	61	65	66	70	71	75	76	999	0	67
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49
04:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	110
05:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	311
06:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	652
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	972
08:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	856
09:00	3	6	6	8	8	52	196	293	343	336	183	156	180	26	24	1	0	0	0	0	0	0	0	0	0	0	747
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	744
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	842
12 PM	3	5	5	8	8	60	279	333	333	333	175	175	32	0	0	0	0	0	0	0	0	0	0	0	0	0	895
13:00	2	2	2	20	20	93	325	304	304	304	104	104	8	0	0	0	0	0	0	0	0	0	0	0	0	0	858
14:00	4	20	17	17	80	251	427	501	501	501	211	211	33	2	0	0	0	0	0	0	0	0	0	0	0	0	1010
15:00	5	6	20	20	71	323	532	532	532	532	34	34	30	5	0	0	0	0	0	0	0	0	0	0	0	0	1172
16:00	0	6	29	29	94	323	532	532	532	532	216	216	24	2	0	0	0	0	0	0	0	0	0	0	0	0	1258
17:00	0	0	2	2	85	349	467	467	467	467	216	216	24	2	0	0	0	0	0	0	0	0	0	0	0	0	1146
18:00	0	1	10	10	31	170	340	340	340	340	199	199	32	4	0	0	0	0	0	0	0	0	0	0	0	0	787
19:00	0	0	1	1	27	143	255	255	255	255	117	117	12	2	0	0	0	0	0	0	0	0	0	0	0	0	558
20:00	0	0	0	0	0	21	89	168	168	168	90	90	24	2	0	0	0	0	0	0	0	0	0	0	0	0	392
21:00	0	0	0	1	7	44	105	105	105	105	74	74	9	6	0	0	0	0	0	0	0	0	0	0	0	0	246
22:00	0	1	1	1	17	65	46	46	46	46	29	29	16	2	0	0	0	0	0	0	0	0	0	0	0	0	198
23:00	0	0	0	0	4	20	44	44	44	44	29	29	16	2	0	0	0	0	0	0	0	0	0	0	0	0	115
Total	17	51	150	150	881	3723	5913	5913	5913	5913	2816	2816	466	43	5	13	93	1015	5829	1015	466	43	5	13	93	1015	14066

Daily

15th Percentile : 31 MPH  
50th Percentile : 36 MPH  
85th Percentile : 42 MPH  
95th Percentile : 44 MPH

Mean Speed(Average) : 37 MPH  
10 MPH Pace Speed : 31-40 MPH  
Number in Pace : 9636  
Percent in Pace : 68.5%  
Number of Vehicles > 35 MPH : 9244  
Percent of Vehicles > 35 MPH : 65.7%

Grand Total	32	92	357	357	1853	7377	11981	11981	11981	11981	5829	5829	1015	93	13	3	0	0	0	0	0	0	0	0	0	0	1	28646
-------------	----	----	-----	-----	------	------	-------	-------	-------	-------	------	------	------	----	----	---	---	---	---	---	---	---	---	---	---	---	---	-------

Overall

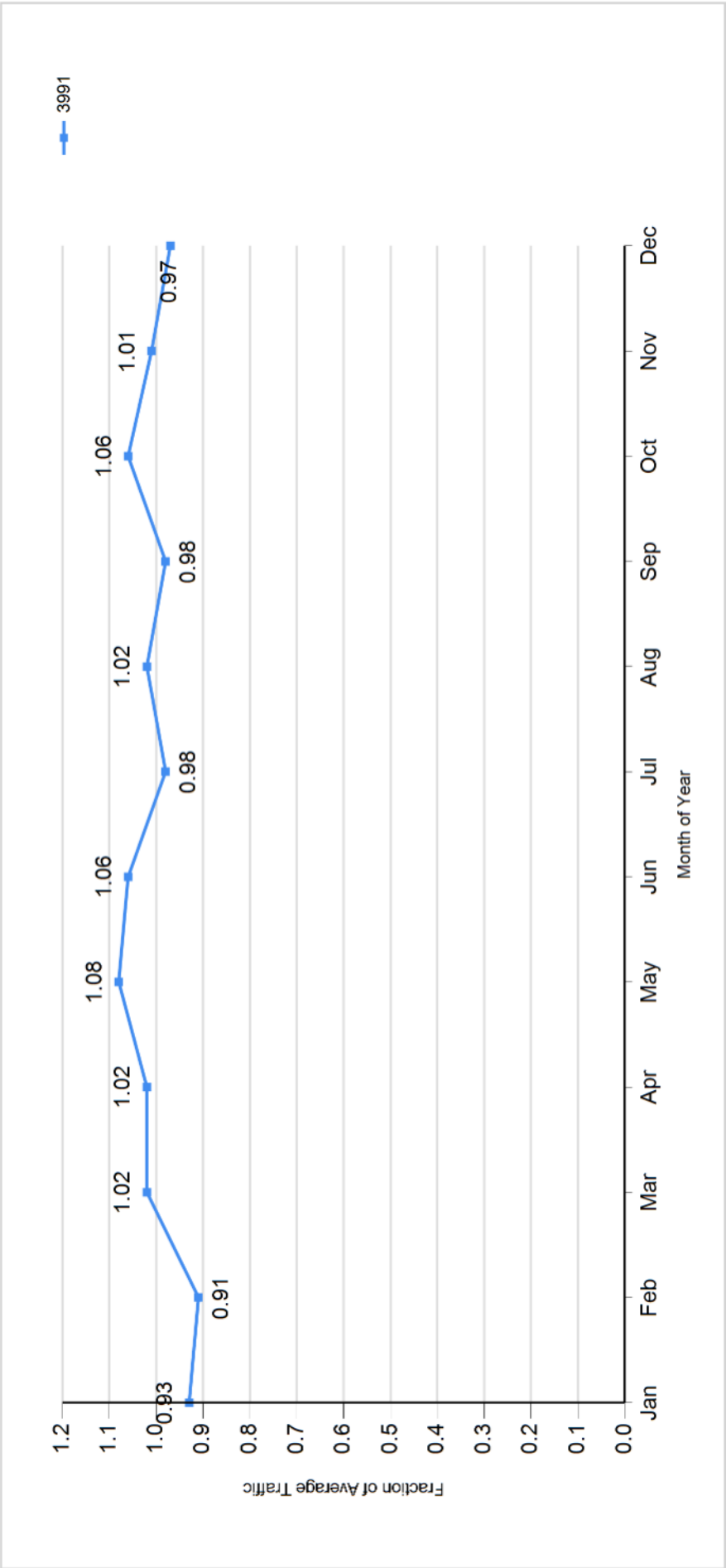
15th Percentile : 31 MPH  
50th Percentile : 36 MPH  
85th Percentile : 42 MPH  
95th Percentile : 44 MPH

Mean Speed(Average) : 37 MPH  
10 MPH Pace Speed : 31-40 MPH  
Number in Pace : 19358  
Percent in Pace : 67.6%  
Number of Vehicles > 35 MPH : 18935  
Percent of Vehicles > 35 MPH : 66.1%

## TRAFFIC ADJUSTMENTS

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Traffic Pattern by Month for 1/1/2018 - 12/31/2018



Traffic Pattern by Month for 1/1/2018 - 12/31/2018

Factor Group	Station	Weight	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
U3	3991	0	0.927	0.912	1.022	1.017	1.078	1.062	0.978	1.020	0.981	1.064	1.014	0.970
	Average of Weighted Factors		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

### **2018 Average Count Data – Sta. 3991**

March ADT: 53,606

Growth Rate: 1.0%/Year

$$53,606 \times (1.010^3) = 55,230$$

### **2021 Average Count Data – Sta. 3991**

March ADT: 47,508

### **COVID Adjustment**

$$\frac{55,230}{47,508} = 1.16$$

Location ID:	3991
County:	WORCESTER
Functional Class	3
Location:	ROUTE 146

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	TOTAL	QC Status
1																										
2																										
3																										
4																										
5																										
6																										
7																										
8																										
9																										
10																										
11																										
12																										
13																										
14																										
15																										
16	500	282	264	274	483	1463	3126	4294	4181	3201	2932	2976	3109	3462	4098	4615	4571	4712	3840	3098	2300	2111	1666	1118	62676	Accepted
17	646	441	343	248	286	566	1078	1754	2167	2590	2845	3246	3667	3650	3655	3708	3676	3610	3268	2741	2086	2016	1916	1350	51553	Accepted
18	759	574	377	269	216	297	606	962	1271	1858	2419	2975	3335	3497	3491	3387	3369	3151	2797	2288	1760	1500	1000	643	42801	Accepted
19	329	216	194	228	483	1587	3154	4256	3949	2844	2454	2567	2753	2812	3506	4032	4269	4343	3093	2246	1652	1268	904	576	53715	Accepted
20	340	240	218	205	494	1546	3267	4320	3903	2859	2578	2693	2804	3131	3780	4159	4469	4579	3403	2423	1834	1484	1042	639	56410	Accepted
21	388	240	194	199	490	1511	2966	3979	3471	2507	2310	2324	2742	2727	3032	3566	3663	3398	2115	1433	1041	838	641	453	46228	Accepted
22	249	172	167	161	408	1223	2611	3663	3358	2491	2164	2320	2602	2713	3471	3982	4205	4381	3110	2332	1808	1537	1032	665	50825	Accepted
23	390	281	207	223	473	1440	3071	4147	3893	2884	2732	2874	3171	3404	3933	4364	4770	4641	3724	2780	2225	1957	1570	1422	60576	Accepted
24	676	445	378	251	259	497	1035	1729	2304	2527	2954	3739	4053	3742	3688	3880	3961	3762	3457	3235	2175	2084	1724	1267	53822	Accepted

# Massachusetts Highway Department

## 3991: Monthly Hourly Volume for March 2021

Location ID:			3991			Seasonal Factor Group: U3																	QC Status				
County:			WORCESTER			Daily Factor Group:																	Accepted				
Functional Class			3			Axle Factor Group: U3																	Accepted				
Location:			ROUTE 146			Growth Factor Group:																	Accepted				
0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	TOTAL	QC Status		
1	1	1	217	165	126	205	420	1285	2610	3155	2944	2395	2282	2423	2653	2821	2787	3468	3600	3370	2483	1760	1179	829	472	44358	Accepted
2	278	178	183	272	468	1600	3157	3618	2979	2329	2349	2452	2596	2592	3169	3818	3662	3505	2544	1784	1248	903	758	531	46973	Accepted	
3	309	206	213	226	489	1411	2768	3411	3047	2543	2229	2599	2838	2990	3617	4010	3889	3809	2814	1941	1355	1000	738	495	48947	Accepted	
4	267	186	201	308	537	1472	2669	3372	3126	2486	2406	2643	2817	2878	3377	3846	3904	3885	2900	2019	1471	1143	784	558	49255	Accepted	
5	292	231	253	263	516	1380	2717	3338	2912	2527	2685	2920	3130	3229	3495	3430	3404	3994	3349	2401	1707	1421	1129	696	51419	Accepted	
6	396	285	211	236	253	537	1039	1318	1724	2173	2742	3193	3422	3526	3489	3520	3255	3095	2824	2326	1756	1445	1069	786	44620	Accepted	
7	440	287	247	172	216	415	858	906	1051	1580	2092	2590	3151	3118	3188	3103	3035	2660	2315	1762	1252	1005	658	403	36504	Accepted	
8	210	189	173	279	479	1480	2795	3110	2995	2267	2226	2514	2757	2971	3406	3809	3943	3561	2554	1794	1156	897	708	473	46746	Accepted	
9	253	164	172	218	425	1383	2679	3305	3059	2355	2464	2621	2794	3041	3448	3971	3779	3610	2677	1883	1314	952	753	493	47813	Accepted	
10	293	242	231	301	583	1445	2462	2925	3218	2694	2642	2354	2786	3223	3762	3891	4108	3851	2869	2005	1397	1087	812	563	49744	Accepted	
11	321	199	211	299	483	1521	2925	3492	3133	2745	2316	2211	2375	2667	3055	3439	3327	3295	2747	2009	1535	1212	958	648	47123	Accepted	
12	410	269	249	314	527	1463	2559	2971	2736	2306	2354	2470	2734	2939	3314	4336	4146	3513	3121	2340	1831	1549	1179	905	50535	Accepted	
13	484	328	282	214	290	691	1092	1379	1773	2136	2609	2908	3172	3688	3425	3801	3618	3313	2966	2386	1833	1519	1163	787	45857	Accepted	
14	468	330	0	268	233	307	504	648	934	1457	1870	2242	2578	3137	3155	2801	2968	2604	2296	1902	1436	1157	828	503	34626	Accepted	
15	302	279	226	267	562	1470	2891	3760	3067	2467	2399	2355	2683	2783	3367	3727	3897	3547	2752	2078	1380	982	737	494	48472	Accepted	
16	314	226	226	268	534	1661	3229	3671	3127	2439	2394	2552	2729	2921	3498	4182	4024	3836	2862	2025	1498	1096	774	499	50585	Accepted	
17	311	187	155	202	422	1319	2558	3145	3124	2546	2472	2724	2854	3275	3780	3504	3887	4085	2976	2333	1728	1183	880	593	50243	Accepted	
18	311	233	214	290	559	1459	2646	3350	3245	2618	2344	2223	3033	3286	3635	3929	3944	3857	2760	2041	1398	1167	834	549	49925	Accepted	
19	389	247	208	245	433	1345	2538	3193	2827	2497	2388	2412	2618	3048	3968	3877	4091	4084	3434	2595	2122	1567	1304	805	52235	Accepted	
20	523	310	299	263	285	529	968	1376	1775	2152	2600	3300	3698	3651	3741	3709	3240	3267	3166	2588	1997	1686	1152	785	47060	Accepted	
21	531	312	244	167	170	280	591	831	1080	1667	2192	2771	2919	3268	3186	3401	3283	2999	2693	2214	1647	1191	838	449	38924	Accepted	
22	283	223	214	244	500	1404	2400	2898	2972	2302	2343	2571	2824	3018	3517	3909	3856	3802	2739	2181	1543	1133	863	515	48254	Accepted	
23	256	164	199	241	458	1486	2729	3444	3112	2317	2379	2664	2823	3124	3659	4097	4029	3882	2852	2224	1517	1142	850	521	50169	Accepted	
24	294	202	161	210	384	1380	2824	3454	3048	2594	2579	2694	2910	3110	3736	4125	4404	3974	3015	2199	1594	1080	806	520	51297	Accepted	
25	313	211	258	290	492	1395	2809	3600	3115	2628	2536	2733	2938	3127	3712	4078	4002	3866	3113	2477	1813	1274	936	602	52318	Accepted	
26	438	295	250	296	507	1394	2508	3225	3139	2799	2750	3157	3327	3582	3730	4380	4196	4082	3423	2713	1924	1604	1277	911	55907	Accepted	
27	576	333	282	272	364	663	1088	1400	1901	2432	2943	3656	3751	3711	3447	3415	3672	3498	2791	2546	2044	1701	1438	966	48890	Accepted	
28	535	347	279	198	165	306	538	707	1010	1700	2125	2706	3023	3049	3069	2879	2615	2371	2102	1768	1281	1006	744	501	35024	Accepted	
29	268	213	192	241	559	1436	2630	3420	3155	2432	2347	2687	2635	2745	3636	3965	3935	3740	2820	2092	1464	1086	789	491	48978	Accepted	
30	286	179	235	244	533	1499	2930	3567	2998	2292	2227	2332	2412	2695	3199	3471	3363	3261	2715	2189	1681	1159	920	554	46941	Accepted	
31	401	261	233	267	505	1461	2780	3582	3147	2648	2381	2487	3089	3533	3932	4288	4317	4090	3062	2253	1627	1233	888	545	53010	Accepted	
March Average																							47508.13				

## PUBLIC TRANSPORTATION SCHEDULES

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# RUGGLES/BACK BAY/SOUTH STATION

## 2021 Spring Schedule Effective April 5, 2021

### Monday to Friday

#### Inbound to Boston

Train No.	AM										PM									
	PROV	NEED	WOR	STOU	FORG	WOR	STOU	FORG	PROV	WOR	WAL	WICK	NEED	STOU	FORG	PROV	WOR	NEED	STOU	FORG
Train comes from																				
1A Ruggles	L 5:16	L 5:37	-	L 5:44	L 6:03	-	L 6:16	L 6:37	-	L 6:44	L 7:03	-	L 7:16	L 7:27	L 7:29	L 7:37	L 7:39	-	L 8:03	L 8:16
1A Back Bay	L 5:20	L 5:41	L 5:44	L 5:48	L 6:07	L 6:16	L 6:20	L 6:41	L 6:44	L 6:48	L 7:07	L 7:16	L 7:20	L 7:31	L 7:33	L 7:41	L 7:43	L 7:44	L 8:07	L 8:16
1A South Station	5:26	5:47	5:50	5:54	6:13	6:22	6:26	6:47	6:50	6:54	7:13	7:22	7:26	7:37	7:38	7:47	7:49	7:50	8:13	8:26

#### Inbound to Boston

Train No.	AM										PM									
	PROV	NEED	WOR	STOU	FORG	PROV	WOR	NEED	STOU	FORG	WAL	WICK	NEED	STOU	FORG	PROV	WOR	NEED	STOU	FORG
Train comes from																				
1A Ruggles	L 5:17	L 5:49	L 2:03	L 2:16	-	L 2:42	L 2:44	L 3:03	-	L 3:21	L 3:34	L 3:42	L 4:03	L 4:16	-	L 4:39	L 4:42	L 5:03	L 5:17	-
1A Back Bay	L 5:40	L 5:53	L 2:07	L 2:20	L 2:22	L 2:45	L 2:48	L 3:07	L 3:22	L 3:25	L 3:38	L 3:46	L 4:07	L 4:20	L 4:22	L 4:43	L 4:45	L 5:07	L 5:21	L 5:22
1A South Station	1:45	1:58	2:12	2:25	2:28	2:50	2:53	3:12	3:28	3:30	3:43	3:50	4:13	4:26	4:28	4:49	4:51	5:13	5:27	5:28

### Monday to Friday

#### Outbound from Boston

Train No.	AM										PM									
	PROV	NEED	WOR	STOU	FORG	WAL	WICK	NEED	STOU	FORG	PROV	WOR	NEED	STOU	FORG	PROV	WOR	NEED	STOU	FORG
Train continues to																				
1A South Station	4:25	4:55	5:25	5:45	5:55	6:25	6:45	6:50	6:55	7:00	7:25	7:45	7:50	7:55	8:00	8:25	8:45	8:50	8:55	9:25
1A Back Bay	4:30	5:01	5:30	5:50	6:01	6:30	6:50	6:55	7:01	7:05	7:30	7:50	7:55	8:01	8:05	8:30	8:50	8:55	9:01	9:02
1A Ruggles	4:33	-	5:33	5:53	-	6:33	6:53	6:58	-	7:08	7:33	7:53	7:58	-	8:08	8:33	8:53	8:58	-	9:05
Train continues to																				
1A South Station	9:25	9:55	10:25	10:45	10:50	11:20	11:40	11:45	11:50	12:05	12:25	12:45	12:50	12:55	1:05	1:20	1:45	1:50	1:55	2:05

#### Outbound from Boston

Train No.	AM										PM									
	PROV	NEED	WOR	STOU	FORG	PROV	WOR	NEED	STOU	FORG	PROV	WOR	NEED	STOU	FORG	PROV	WOR	NEED	STOU	FORG
Train comes from																				
1A Ruggles	L 7:24	-	L 9:24	-	L 11:09	-	L 12:54	-	L 2:54	-	L 4:54	-	L 6:54	-	L 10:02	-				
1A Back Bay	L 7:28	L 8:35	L 9:28	L 10:35	L 11:13	L 12:35	L 12:58	L 2:35	L 2:58	L 4:35	L 4:58	L 6:35	L 6:58	L 8:35	L 10:06	L 10:35				
1A South Station	7:33	8:40	9:33	10:40	11:18	12:40	1:03	2:40	3:03	4:40	5:03	6:40	7:03	8:40	10:11	10:40				

### Saturday, Sunday & Holidays

#### Inbound to Boston

Train No.	AM										PM									
	PROV	NEED	WOR	STOU	FORG	PROV	WOR	NEED	STOU	FORG	PROV	WOR	NEED	STOU	FORG	PROV	WOR	NEED	STOU	FORG
Train comes from																				
1A Ruggles	L 7:24	-	L 9:24	-	L 11:09	-	L 12:54	-	L 2:54	-	L 4:54	-	L 6:54	-	L 10:02	-				
1A Back Bay	L 7:28	L 8:35	L 9:28	L 10:35	L 11:13	L 12:35	L 12:58	L 2:35	L 2:58	L 4:35	L 4:58	L 6:35	L 6:58	L 8:35	L 10:06	L 10:35				
1A South Station	7:33	8:40	9:33	10:40	11:18	12:40	1:03	2:40	3:03	4:40	5:03	6:40	7:03	8:40	10:11	10:40				

### Saturday, Sunday & Holidays

#### Outbound from Boston

Train No.	AM										PM									
	PROV	NEED	WOR	STOU	FORG	PROV	WOR	NEED	STOU	FORG	PROV	WOR	NEED	STOU	FORG	PROV	WOR	NEED	STOU	FORG
Train comes from																				
1A South Station	6:40	7:00	8:40	9:00	10:20	11:00	12:20	1:00	2:20	3:00	4:20	5:00	6:45	7:00	8:45	9:00				
1A Back Bay	6:45	7:06	8:45	9:06	10:25	11:06	12:25	1:06	2:25	3:06	4:25	5:06	6:50	7:06	8:50	9:06				
1A Ruggles	6:48	-	8:48	-	10:28	-	12:28	-	2:28	-	4:28	-	6:53	-	8:53	-				
Train continues to																				
1A South Station	9:25	9:55	10:25	10:45	10:50	11:20	11:40	11:45	11:50	12:05	12:25	12:45	12:50	12:55	1:05	1:20	1:45	1:50	1:55	2:05

This schedule displays all trains which make connecting stops at Ruggles, Back Bay and South Station (all Zone 1A stations). Please keep in mind that outbound trains will make regularly scheduled local stops en route to their final station stop.

## Keep in Mind:

This schedule will be effective from April 5, 2021 and will replace the schedule of January 23, 2021.

### Holiday Service

For Memorial day and for Independence Day, the Providence and Worcester lines will operate on a weekend schedule. For holiday service on the Needham and Franklin lines, please visit MBTA.com/holidays or pick up the dedicated holiday schedule at South Station or Back Bay three weeks prior to the holiday.

Masks are federally required on board and in station. Visit [MBTA.com/covid19](https://www.mbta.com/covid19) for the latest updates.



Times in blue with "L" indicate an early departure: The train may leave ahead of schedule at these stops.



Bikes: Bicycles are allowed on all trains.



High level platform and bridge plate available. Visit [mbta.com/accessibility](https://www.mbta.com/accessibility) for more information.

## MOTOR VEHICLE CRASH DATA

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Crash Number	City Town Name	Crash Date	Crash Severity	Crash Time	Max Injury Severity Reported	Light Conditions	Manner of Collision	Road Surface Condition	Roadway Junction Type	Traffic Control Device Type	Trafficway Description	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Travel Direction s (All Vehicles)	Weather Conditions	First Harmful Event Location	Road Contributing Circumstance	Latitude	Longitude	Street Number	Roadway	Near Intersecting on Roadway
WORCESTER ST Rte 122 / BRIGHAM HILL RD																					
3822135	GRAFTON	02/19/2014	Property damage only (none injured)	3:25 PM	No injury	Daylight	Angle	Snow	T-intersection	Stop signs	Two-way, not divided	V1: Turning right / V2: Travelling straight ahead	V1: W / V2: N	Snow	Roadway	Other	42.22834	-71.7276		WORCESTER ST Rte 122 / BRIGHAM HILL ROAD / MAPLEWOOD DRIVE	
4565067	GRAFTON	05/29/2018	Property damage only (none injured)	7:52 AM	No injury	Daylight	Angle	Dry	T-intersection	Stop signs	Two-way, not divided	V1: Turning right / V2: Entering traffic lane	V1: S / V2: N	Clear	Roadway	None	42.22845	-71.7277		WORCESTER ST Rte 122 / BRIGHAM HILL RD	
WORCESTER ST Rte 122 / HILTOP STREET																					
3925663	GRAFTON	05/29/2014	Property damage only (none injured)	9:56 AM	No injury	Daylight	Rear-end	Dry	Not at junction	No controls	Two-way, not divided	V1: Travelling straight ahead / V2: Travelling straight ahead / V3: Travelling straight ahead	V1: W / V2: W / V3: W	Clear	Roadway	None	42.22836	-71.7309	267	WORCESTER STREET	
RAMP-RT 90 TO RT 122 / GRAFTON ROAD Rte 122																					
3845573	MILLBURY	06/14/2014	Property damage only (none injured)	9:45 AM	No injury	Daylight	Rear-end	Dry	On-ramp	Yield signs	One-way, not divided	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: N / V2: N	Cloudy	Roadway	Not reported	42.22979	-71.7388		RAMP-RT 122 TO RT 90	ONRAMP TO RT 90 IC 11 TOLL PLAZA
3850250	MILLBURY	06/13/2014	Property damage only (none injured)	12:30 PM	No injury	Daylight	Rear-end	Dry	Y-intersection	Traffic control signal	One-way, not divided	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: S / V2: S	Cloudy	Roadway	Not reported	42.23029	-71.7386		RAMP-RT 90 TO RT 122 / GRAFTON ROAD Rte 122	IC 11
4049212	MILLBURY	03/31/2015	Non-fatal injury	7:39 AM	Non-fatal injury - Non-incapacitating	Daylight	Rear-end	Dry	T-intersection	Traffic control signal	Two-way, divided, unprotected median	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: S / V2: S	Clear	Roadway	Not reported	42.23029	-71.7386		RAMP-RT 122 TO RT 90 / GRAFTON ROAD Rte SR122 N	Exit 11/route 90
4192935	MILLBURY	04/23/2016	Property damage only (none injured)	4:07 PM	No injury	Daylight	Rear-end	Dry	Off-ramp	Stop signs	One-way, not divided	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: S / V2: S	Clear	Roadway	None	42.23021	-71.7378		GRAFTON ROAD Rte SR122 N / RAMP-RT 90 TO RT 122	
4234510	MILLBURY	08/16/2016	Property damage only (none injured)	4:55 PM	No injury	Daylight	Rear-end	Dry	Y-intersection	Yield signs	One-way, not divided	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: E / V2: E	Clear	Roadway	None	42.23015	-71.739		RAMP-RT 122 TO RT 90	GRAFTON ROAD Rte 122 S
4247048	MILLBURY	09/07/2016	Property damage only (none injured)	7:39 AM	No injury	Daylight	Rear-to-rear	Wet	Y-intersection	Yield signs	Two-way, divided, positive median barrier	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: S / V2: S	Rain	Roadway	Road surface condition (wet, icy, snow, slush, etc.)	42.23029	-71.7386		RAMP-RT 122 TO RT 90 / RAMP-RT 90 TO RT 122 / MASS PIKE EXIT 11	MASS PIKE EXIT 11
4366911	MILLBURY	05/05/2017	Property damage only (none injured)	4:04 PM	No injury	Daylight	Side, same direction	Wet	T-intersection	Traffic control signal	Two-way, divided, unprotected median	V1: Turning right / V2: Travelling straight ahead / V3: Travelling straight ahead	V1: S / V2: S / V3: S	Cloudy/Rain	Roadway	None	42.23021	-71.7378		GRAFTON ROAD Rte 122	OAKES STREET
4626427	MILLBURY	10/21/2018	Non-fatal injury	7:56 PM	Non-fatal injury - Non-incapacitating	Daylight	Head-on	Dry	T-intersection	Traffic control signal	Two-way, divided, unprotected median	V1: Travelling straight ahead / V2: Turning left	V1: S / V2: E	Clear	Roadway	None	42.23028	-71.7386		GRAFTON ROAD Rte SR122 S / RAMP-RT 90 TO RT 122	

# MassHighway

## CRASH RATE WORKSHEET

CITY/TOWN : North Grafton COUNT DATE : 2021

DISTRICT : 3 UNSIGNALIZED : ☒ SIGNALIZED : ☐

**MHD USE ONLY**

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Worcester Street (Route 122)

ST #

MINOR STREET(S) : Wyman-Gordon Main driveway/Brigham Hill Road

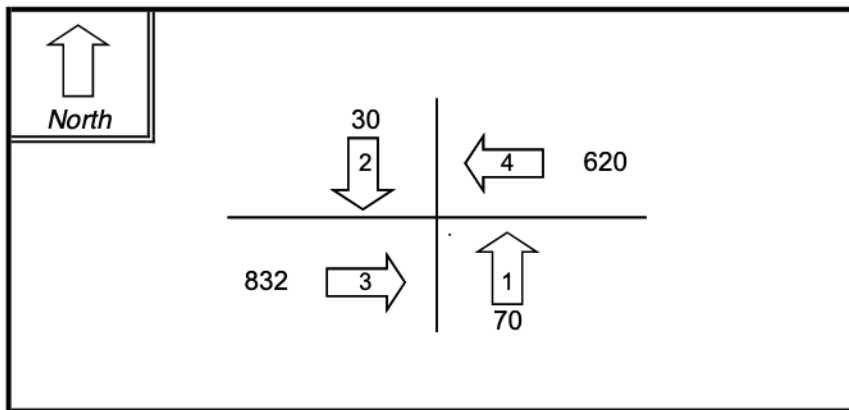
ST #

ST #

ST #

ST #

**INTERSECTION  
DIAGRAM**  
(Label Approaches)



INTERSECTION

REF #

**Peak Hour Volumes**

APPROACH :	1	2	3	4	Total Entering Vehicles
DIRECTION :	NB	SB	EB	WB	
VOLUMES (PM) :	70	30	832	620	1,552

" K " FACTOR :  APPROACH ADT :  ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS :  # OF YEARS :  AVERAGE # OF ACCIDENTS ( A ) :

**CRASH RATE CALCULATION :**  RATE =  $\frac{(A * 1,000,000)}{(ADT * 365)}$

Comments : Accident Rate for District 3 signalized intersections = 0.89

Accident Rate for District 3 unsignalized intersections = 0.61

Statewide = Signalized Intersection - 0.78 Unsignalized - 0.57

# MassHighway

## CRASH RATE WORKSHEET

CITY/TOWN : North Grafton COUNT DATE : 2021

DISTRICT : 3 UNSIGNALIZED : ☒ SIGNALIZED : ☐

**MHD USE ONLY**

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Worcester Street (Route 122)

MINOR STREET(S) : Hilltop Street

ST #

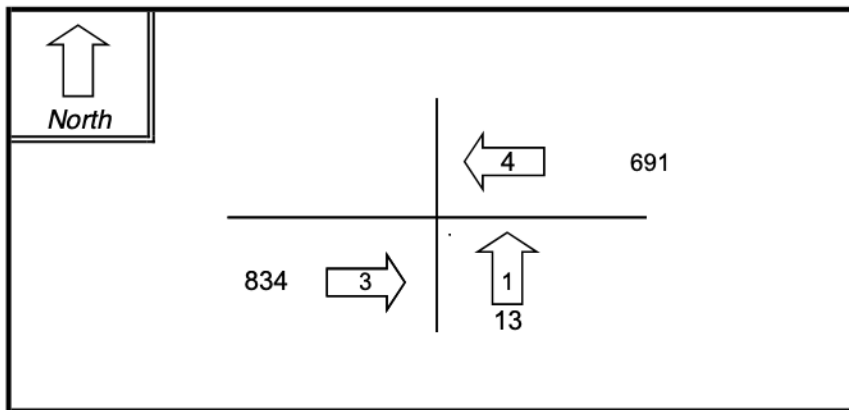
ST #

ST #

ST #

ST #

**INTERSECTION  
DIAGRAM**  
(Label Approaches)



INTERSECTION

REF #

**Peak Hour Volumes**

APPROACH :	1	2	3	4	5	Total Entering Vehicles
DIRECTION :	NB		EB	WB		
VOLUMES (PM) :	13		834	691		1,538

" K " FACTOR :  APPROACH ADT :  ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS :  # OF YEARS :  AVERAGE # OF ACCIDENTS ( A ) :

**CRASH RATE CALCULATION :**  RATE =  $\frac{(A * 1,000,000)}{(ADT * 365)}$

Comments : Accident Rate for District 3 signalized intersections = 0.89

Accident Rate for District 3 unsignalized intersections = 0.61

Statewide = Signalized Intersection - 0.78 Unsignalized - 0.57

# MassHighway

## CRASH RATE WORKSHEET

CITY/TOWN : North Grafton COUNT DATE : 2021

DISTRICT : 3 UNSIGNALIZED : ☐ SIGNALIZED : ☒

**MHD USE ONLY**

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Worcester Street (Route 122)

ST #

MINOR STREET(S) : Massachusetts Turnpike (I-90) – Westbound Ramp (Exit 11)

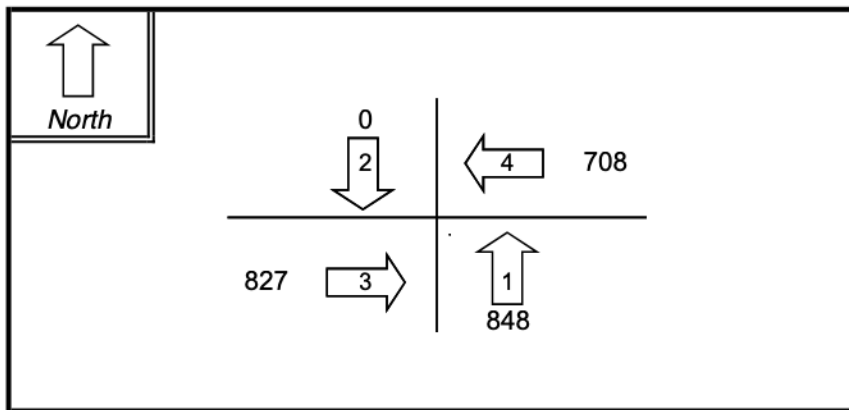
ST #

ST #

ST #

ST #

**INTERSECTION  
DIAGRAM**  
(Label Approaches)



INTERSECTION

REF #

**Peak Hour Volumes**

APPROACH :	1	2	3	4	Total Entering Vehicles
DIRECTION :	NB	SB	EB	WB	
VOLUMES (PM) :	848	0	827	708	2,383

" K " FACTOR :  APPROACH ADT :  ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS :  # OF YEARS :  AVERAGE # OF ACCIDENTS ( A ) :

**CRASH RATE CALCULATION :**  RATE =  $\frac{(A * 1,000,000)}{(ADT * 365)}$

Comments : Accident Rate for District 3 signalized intersections = 0.89

Accident Rate for District 3 unsignalized intersections = 0.61

Statewide = Signalized Intersection - 0.78 Unsignalized - 0.57

## GROWTH RATE CALCULATIONS

---

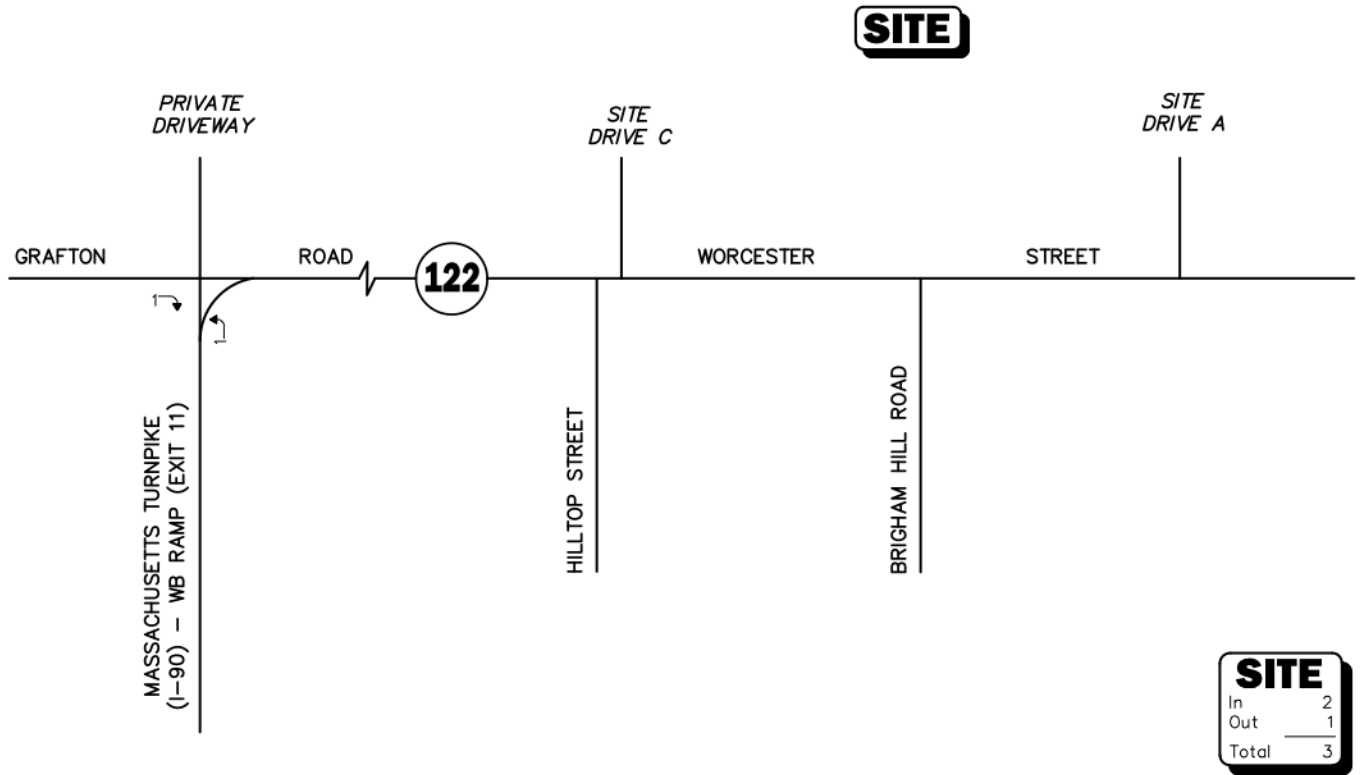
General Background Traffic Growth - Daily Traffic Volumes

ID	CITY/TOWN	LOCATION	2015	2016	2017	2018	2019	Average Annual
2440691	Grafton	WORCESTER STREET			14,559	14,763	14,822	0.90%
3186	Grafton	WORCESTER STREET	15,406	15,735	15,908	16,131	14,940	-0.39%
240692	Millbury	GRAFTON ROAD NORTH OF RAYMOND STREET			15,667	15,886	15,950	0.90%
RPA05-110-1549	Grafton	WORCESTER STREET NORTH OF Bridge Street			15,464	15,682	15,745	0.91%
0.58%								
SAY 1%								

## BACKGROUND DEVELOPMENT

---

WEEKDAY MORNING PEAK HOUR (7:15 - 8:15 AM)



WEEKDAY EVENING PEAK HOUR (4:00 - 5:00 PM)

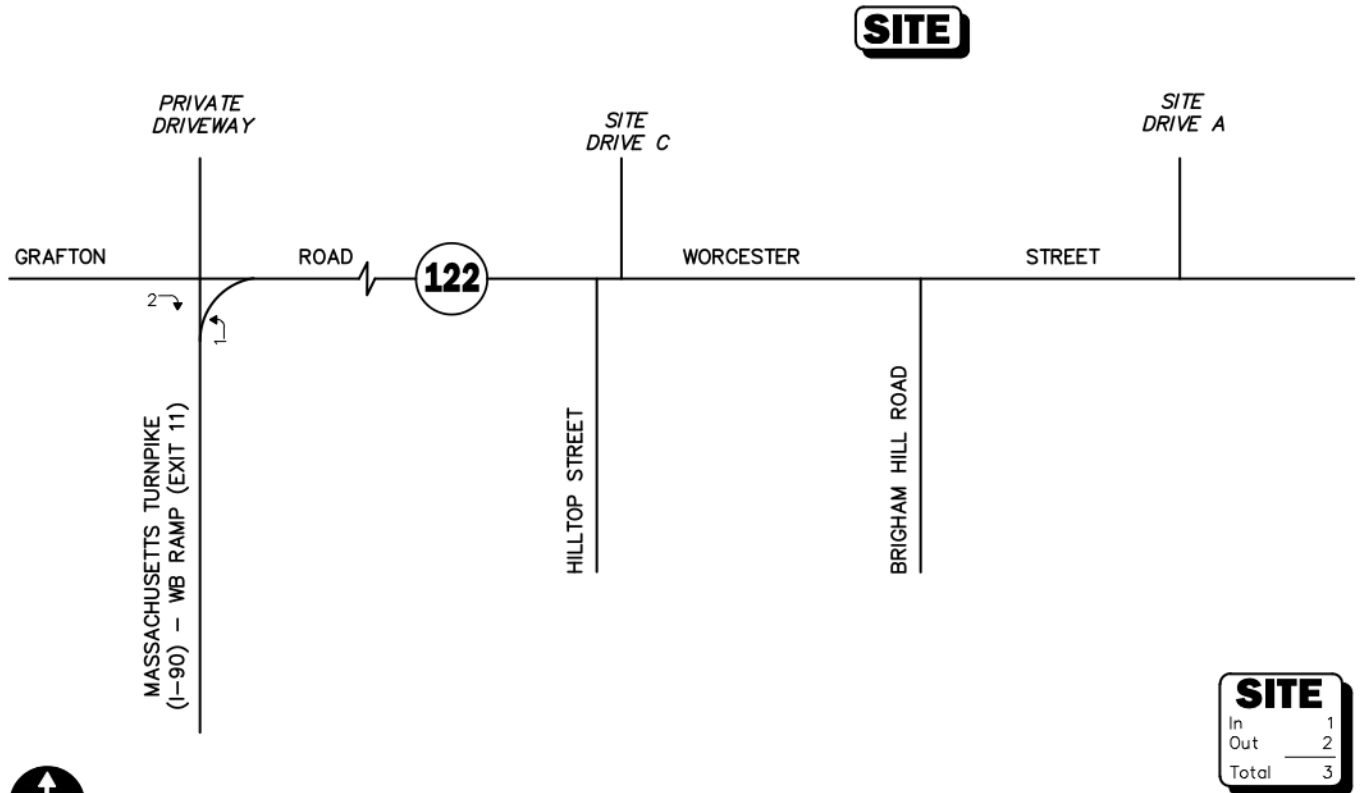


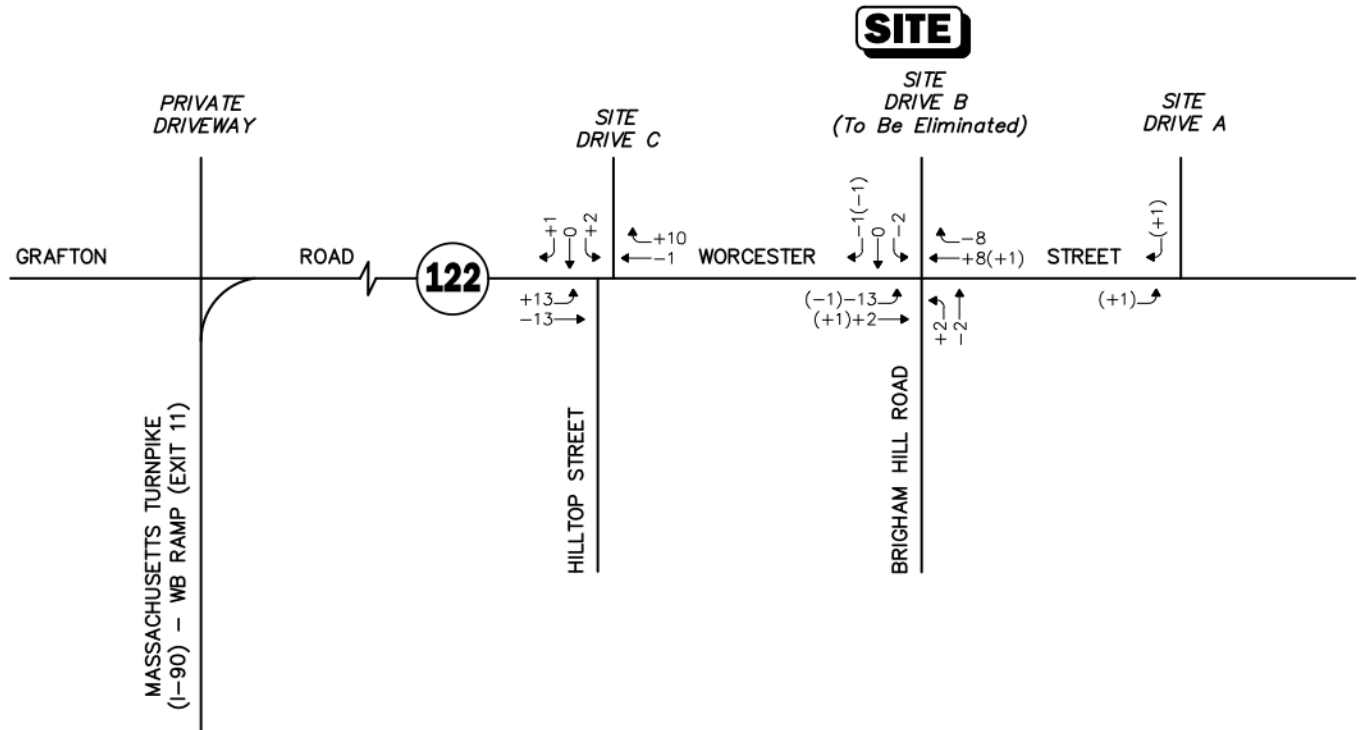
Figure A1



Abbot Place  
Proposed Mixed-Use Development  
4 Abbott Road  
Weekday  
Peak Hour Traffic Volumes

## WYMAN-GORDON TRIP REDISTRIBUTION

WEEKDAY MORNING PEAK HOUR (7:15 - 8:15 AM)



WEEKDAY EVENING PEAK HOUR (4:00 - 5:00 PM)

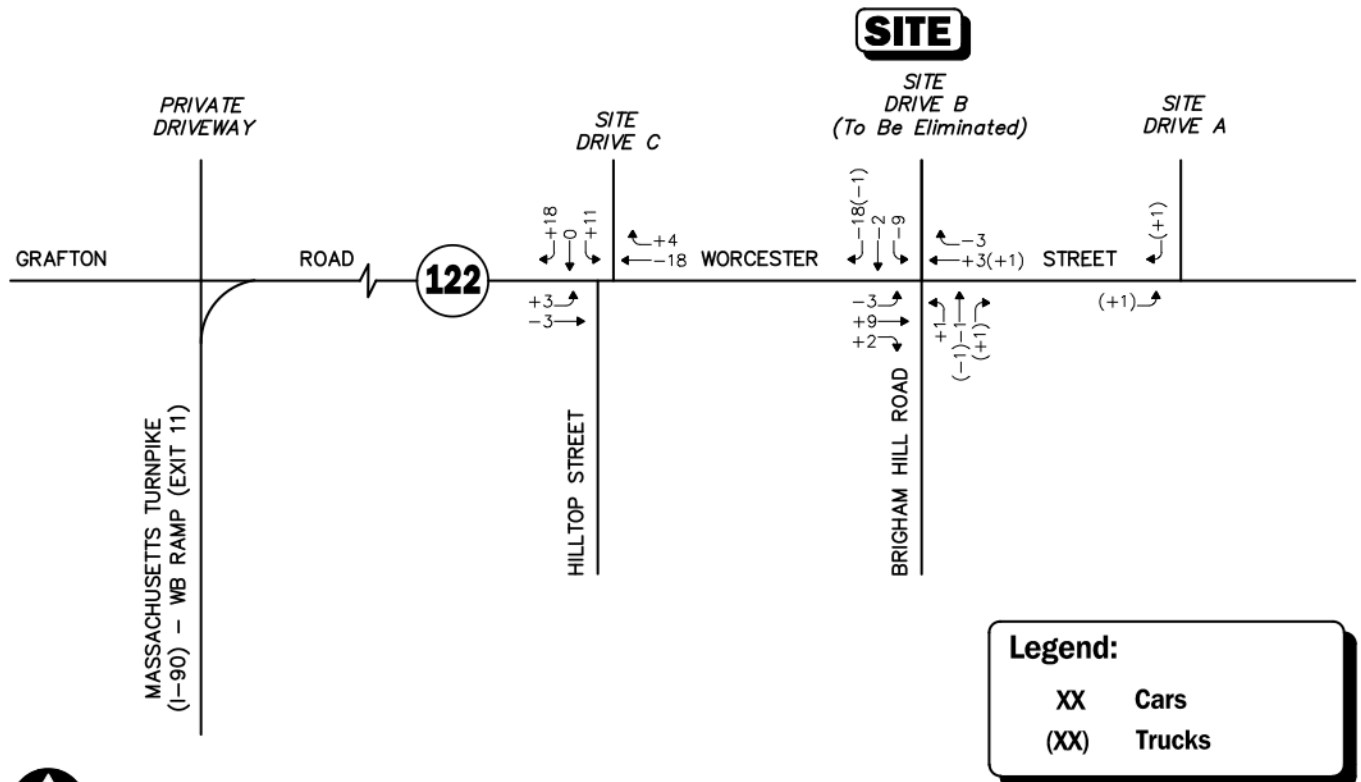


Figure A2

Wyman Gordon cars/employees  
Trip Redistribution  
Weekday  
Peak Hour Traffic Volumes

## TRIP GENERATION

---

**Institute of Transportation Engineers (ITE)**  
**Trip Generation, 10th Edition**  
**Land Use Code (LUC) 150 - Warehousing**

Average Vehicle Trips Ends vs: 1000 Sq. Feet Gross Floor Area  
 Independent Variable (X): 375

R<sup>2</sup>

Equation

**0.93 AVERAGE WEEKDAY DAILY**

$$T = 1.58 (X) + 45.54$$

$$T = 1.58 * 375 + (45.54)$$

$$T = 638.04$$

$$T = 638 \text{ vehicle trips}$$

with 50% ( 319 vpd) entering and 50% ( 319 vpd) exiting.

Rate

**AVERAGE WEEKDAY DAILY**

$$T = 1.74 * (X)$$

$$T = 1.74 * 375$$

$$T = 652.50$$

$$T = 654 \text{ vehicle trips}$$

with 50% ( 327 vpd) entering and 50% ( 327 vpd) exiting.

**0.69 WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC**

$$T = 0.12 (X) + 25.32$$

$$T = 0.12 ( 375 ) + (25.32)$$

$$T = 70.32$$

$$T = 70 \text{ vehicle trips}$$

with 77% ( 54 vph) entering and 23% ( 16 vph) exiting.

**WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC**

$$T = 0.17 * (X)$$

$$T = 0.17 * 375$$

$$T = 63.75$$

$$T = 64 \text{ vehicle trips}$$

with 77% ( 49 vph) entering and 23% ( 15 vph) exiting.

**0.65 WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC**

$$T = 0.12 (X) + 27.82$$

$$T = 0.12 ( 375 ) + (27.82)$$

$$T = 72.82$$

$$T = 73 \text{ vehicle trips}$$

with 27% ( 20 vph) entering and 73% ( 53 vph) exiting.

**WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC**

$$T = 0.19 * (X)$$

$$T = 0.19 * 375$$

$$T = 71.25$$

$$T = 71 \text{ vehicle trips}$$

with 27% ( 19 vph) entering and 73% ( 52 vph) exiting.

**SATURDAY DAILY**

$$T = 0.15 * (X)$$

$$T = 0.15 * 375$$

$$T = 56.25$$

$$T = 56 \text{ vehicle trips}$$

with 50% ( 28 vpd) entering and 50% ( 28 vpd) exiting.

**SATURDAY DAILY**

$$T = 0.15 * (X)$$

$$T = 0.15 * 375$$

$$T = 56.25$$

$$T = 56 \text{ vehicle trips}$$

with 50% ( 28 vpd) entering and 50% ( 28 vpd) exiting.

**SATURDAY MIDDAY PEAK HOUR OF GENERATOR**

$$T = 0.05 * (X)$$

$$T = 0.05 * 375$$

$$T = 18.75$$

$$T = 19 \text{ vehicle trips}$$

with 64% ( 12 vph) entering and 36% ( 7 vph) exiting.

**SATURDAY MIDDAY PEAK HOUR OF GENERATOR**

$$T = 0.05 * (X)$$

$$T = 0.05 * 375$$

$$T = 18.75$$

$$T = 19 \text{ vehicle trips}$$

with 64% ( 12 vph) entering and 36% ( 7 vph) exiting.

Institute of Transportation Engineers (ITE)  
*Trip Generation, 10th Edition*  
Land Use Code (LUC) 150 - Warehousing

Average Truck Trips Ends vs: 1000 Sq. Feet Gross Floor Area  
Independent Variable (X): 375

R<sup>2</sup>

Equation

0.61 AVERAGE WEEKDAY DAILY

T = 0.54 (X) + 7.47  
T = 0.54 \* 375 + (7.47)  
T = 209.97  
T = 210 vehicle trips  
with 50% ( 105 vpd) entering and 50% ( 105 vpd) exiting.

Rate

AVERAGE WEEKDAY DAILY

T = 0.60 \* (X)  
T = 0.60 \* 375  
T = 225.00  
T = 226 vehicle trips  
with 50% ( 113 vpd) entering and 50% ( 113 vpd) exiting.

-- WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 0.02 \* (X)  
T = 0.02 \* 375  
T = 7.50  
T = 8 vehicle trips  
with 52% ( 4 vph) entering and 48% ( 4 vph) exiting.

-- WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 0.03 \* (X)  
T = 0.03 \* 375  
T = 11.25  
T = 11 vehicle trips  
with 52% ( 6 vph) entering and 48% ( 5 vph) exiting.

## **CAPACITY ANALYSIS**

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Worcester Street (Route 122) at Site Drive A




Worcester Street (Route 122) at Brigham Hill Road/Site Drive B (To be Eliminated)




Worcester Street (Route 122) at Hilltop Street/ Site Drive C




Grafton Road (Route 122) at Massachusetts Turnpike (I-90) – Westbound Ramp (Exit 11 )




Worcester Street (Route 122) at Site Drive A

---

Intersection						
Int Delay, s/veh	0					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	475	493	0	0	1
Future Vol, veh/h	1	475	493	0	0	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	87	87	90	90	25	25
Heavy Vehicles, %	0	3	4	0	0	0
Mvmt Flow	1	546	548	0	0	4
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	548	0	-	0	1096	548
Stage 1	-	-	-	-	548	-
Stage 2	-	-	-	-	548	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1032	-	-	-	238	540
Stage 1	-	-	-	-	583	-
Stage 2	-	-	-	-	583	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1032	-	-	-	238	540
Mov Cap-2 Maneuver	-	-	-	-	238	-
Stage 1	-	-	-	-	582	-
Stage 2	-	-	-	-	583	-
Approach	EB	WB		SB		
HCM Control Delay, s	0	0		11.7		
HCM LOS	B					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1032	-	-	-	540	
HCM Lane V/C Ratio	0.001	-	-	-	0.007	
HCM Control Delay (s)	8.5	0	-	-	11.7	
HCM Lane LOS	A	A	-	-	B	
HCM 95th %tile Q(veh)	0	-	-	-	0	

Intersection						
Int Delay, s/veh	0					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	682	620	0	0	0
Future Vol, veh/h	0	682	620	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	89	89	92	92
Heavy Vehicles, %	0	1	2	0	0	0
Mvmt Flow	0	758	697	0	0	0
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	697	0	-	0	1455	697
Stage 1	-	-	-	-	697	-
Stage 2	-	-	-	-	758	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	909	-	-	-	145	444
Stage 1	-	-	-	-	498	-
Stage 2	-	-	-	-	466	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	909	-	-	-	145	444
Mov Cap-2 Maneuver	-	-	-	-	145	-
Stage 1	-	-	-	-	498	-
Stage 2	-	-	-	-	466	-
Approach	EB	WB		SB		
HCM Control Delay, s	0	0		0		
HCM LOS	A					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	909	-	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-
HCM Control Delay (s)	0	-	-	-	-	0
HCM Lane LOS	A	-	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-	-




Intersection						
Int Delay, s/veh	0					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	509	528	0	0	1
Future Vol, veh/h	1	509	528	0	0	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	87	87	90	90	25	25
Heavy Vehicles, %	0	3	4	0	0	0
Mvmt Flow	1	585	587	0	0	4
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	587	0	-	0	1174	587
Stage 1	-	-	-	-	587	-
Stage 2	-	-	-	-	587	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	998	-	-	-	214	513
Stage 1	-	-	-	-	560	-
Stage 2	-	-	-	-	560	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	998	-	-	-	214	513
Mov Cap-2 Maneuver	-	-	-	-	214	-
Stage 1	-	-	-	-	559	-
Stage 2	-	-	-	-	560	-
Approach	EB	WB		SB		
HCM Control Delay, s	0	0		12.1		
HCM LOS	B					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	998	-	-	-	513	
HCM Lane V/C Ratio	0.001	-	-	-	0.008	
HCM Control Delay (s)	8.6	0	-	-	12.1	
HCM Lane LOS	A	A	-	-	B	
HCM 95th %tile Q(veh)	0	-	-	-	0	




Intersection						
Int Delay, s/veh	0					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	731	667	0	0	0
Future Vol, veh/h	0	731	667	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	89	89	92	92
Heavy Vehicles, %	0	1	2	0	0	0
Mvmt Flow	0	812	749	0	0	0

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	749	0	0	1561	749
Stage 1	-	-	-	749	-
Stage 2	-	-	-	812	-
Critical Hdwy	4.1	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	3.5	3.3
Pot Cap-1 Maneuver	869	-	-	125	415
Stage 1	-	-	-	471	-
Stage 2	-	-	-	440	-
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	869	-	-	125	415
Mov Cap-2 Maneuver	-	-	-	125	-
Stage 1	-	-	-	471	-
Stage 2	-	-	-	440	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	869	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	-	0
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-

Intersection						
Int Delay, s/veh	0.5					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	36	509	528	15	4	13
Future Vol, veh/h	36	509	528	15	4	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	87	87	90	90	92	92
Heavy Vehicles, %	0	3	4	0	0	0
Mvmt Flow	41	585	587	17	4	14
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	604	0	-	0	1263	596
Stage 1	-	-	-	-	596	-
Stage 2	-	-	-	-	667	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	984	-	-	-	189	507
Stage 1	-	-	-	-	554	-
Stage 2	-	-	-	-	514	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	984	-	-	-	177	507
Mov Cap-2 Maneuver	-	-	-	-	177	-
Stage 1	-	-	-	-	520	-
Stage 2	-	-	-	-	514	-
Approach	EB	WB		SB		
HCM Control Delay, s	0.6	0		15.8		
HCM LOS	C					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	984	-	-	-	352	
HCM Lane V/C Ratio	0.042	-	-	-	0.052	
HCM Control Delay (s)	8.8	0	-	-	15.8	
HCM Lane LOS	A	A	-	-	C	
HCM 95th %tile Q(veh)	0.1	-	-	-	0.2	

Intersection						
Int Delay, s/veh	1					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	14	731	667	6	16	37
Future Vol, veh/h	14	731	667	6	16	37
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	89	89	92	92
Heavy Vehicles, %	0	1	2	0	0	0
Mvmt Flow	16	812	749	7	17	40
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	756	0	-	0	1597	753
Stage 1	-	-	-	-	753	-
Stage 2	-	-	-	-	844	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	864	-	-	-	118	413
Stage 1	-	-	-	-	469	-
Stage 2	-	-	-	-	425	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	864	-	-	-	114	413
Mov Cap-2 Maneuver	-	-	-	-	114	-
Stage 1	-	-	-	-	453	-
Stage 2	-	-	-	-	425	-
Approach	EB	WB		SB		
HCM Control Delay, s	0.2	0		25.8		
HCM LOS	D					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	864	-	-	-	230	
HCM Lane V/C Ratio	0.018	-	-	-	0.25	
HCM Control Delay (s)	9.2	0	-	-	25.8	
HCM Lane LOS	A	A	-	-	D	
HCM 95th %tile Q(veh)	0.1	-	-	-	1	

Worcester Street (Route 122) at Brigham Hill Road/Site Drive B (To be Eliminated)

Intersection												
Int Delay, s/veh	14.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	14	468	50	9	477	8	151	2	6	2	0	2
Future Vol, veh/h	14	468	50	9	477	8	151	2	6	2	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	91	91	91	90	90	90	33	33	33
Heavy Vehicles, %	7	2	7	0	4	0	0	0	0	50	0	0
Mvmt Flow	15	509	54	10	524	9	168	2	7	6	0	6
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	533	0	0	563	0	0	1118	1119	536	1120	1142	529
Stage 1	-	-	-	-	-	-	566	566	-	549	549	-
Stage 2	-	-	-	-	-	-	552	553	-	571	593	-
Critical Hdwy	4.17	-	-	4.1	-	-	7.1	6.5	6.2	7.6	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.6	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.6	5.5	-
Follow-up Hdwy	2.263	-	-	2.2	-	-	3.5	4	3.3	3.95	4	3.3
Pot Cap-1 Maneuver	1010	-	-	1019	-	-	186	209	549	149	202	554
Stage 1	-	-	-	-	-	-	513	511	-	443	520	-
Stage 2	-	-	-	-	-	-	522	518	-	431	497	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1010	-	-	1019	-	-	179	201	549	142	195	554
Mov Cap-2 Maneuver	-	-	-	-	-	-	179	201	-	142	195	-
Stage 1	-	-	-	-	-	-	502	500	-	433	513	-
Stage 2	-	-	-	-	-	-	509	511	-	415	486	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.2			0.2			108			21.8		
HCM LOS							F			C		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	184	1010	-	-	1019	-	-	226				
HCM Lane V/C Ratio	0.96	0.015	-	-	0.01	-	-	0.054				
HCM Control Delay (s)	108	8.6	0	-	8.6	0	-	21.8				
HCM Lane LOS	F	A	A	-	A	A	-	C				
HCM 95th %tile Q(veh)	7.7	0	-	-	0	-	-	0.2				

Intersection												
Int Delay, s/veh	7.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	3	667	162	7	610	3	62	2	6	9	2	19
Future Vol, veh/h	3	667	162	7	610	3	62	2	6	9	2	19
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	90	90	90	88	88	88	57	57	57
Heavy Vehicles, %	0	1	0	0	2	0	0	50	0	0	0	5
Mvmt Flow	3	725	176	8	678	3	70	2	7	16	4	33
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	681	0	0	901	0	0	1533	1516	813	1520	1603	680
Stage 1	-	-	-	-	-	-	819	819	-	696	696	-
Stage 2	-	-	-	-	-	-	714	697	-	824	907	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	7	6.2	7.1	6.5	6.25
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	6	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	6	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4.45	3.3	3.5	4	3.345
Pot Cap-1 Maneuver	921	-	-	763	-	-	96	94	382	98	107	446
Stage 1	-	-	-	-	-	-	372	329	-	435	446	-
Stage 2	-	-	-	-	-	-	425	378	-	370	357	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	921	-	-	763	-	-	85	92	382	93	104	446
Mov Cap-2 Maneuver	-	-	-	-	-	-	85	92	-	93	104	-
Stage 1	-	-	-	-	-	-	369	327	-	432	438	-
Stage 2	-	-	-	-	-	-	383	372	-	358	355	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0.1			144.2			31.2		
HCM LOS							F			D		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	91	921	-	-	763	-	-	189				
HCM Lane V/C Ratio	0.874	0.004	-	-	0.01	-	-	0.278				
HCM Control Delay (s)	144.2	8.9	0	-	9.8	0	-	31.2				
HCM Lane LOS	F	A	A	-	A	A	-	D				
HCM 95th %tile Q(veh)	4.8	0	-	-	0	-	-	1.1				

Intersection												
Int Delay, s/veh	24.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	14	502	54	10	511	8	162	2	6	2	0	2
Future Vol, veh/h	14	502	54	10	511	8	162	2	6	2	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	91	91	91	90	90	90	33	33	33
Heavy Vehicles, %	7	2	7	0	4	0	0	0	0	50	0	0
Mvmt Flow	15	546	59	11	562	9	180	2	7	6	0	6

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	571	0	0	605	0	0	1198	1199	576	1199	1224	567
Stage 1	-	-	-	-	-	-	606	606	-	589	589	-
Stage 2	-	-	-	-	-	-	592	593	-	610	635	-
Critical Hdwy	4.17	-	-	4.1	-	-	7.1	6.5	6.2	7.6	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.6	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.6	5.5	-
Follow-up Hdwy	2.263	-	-	2.2	-	-	3.5	4	3.3	3.95	4	3.3
Pot Cap-1 Maneuver	977	-	-	983	-	-	~ 164	187	521	130	181	527
Stage 1	-	-	-	-	-	-	487	490	-	420	499	-
Stage 2	-	-	-	-	-	-	496	497	-	409	476	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	977	-	-	983	-	-	~ 157	180	521	123	174	527
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 157	180	-	123	174	-
Stage 1	-	-	-	-	-	-	476	479	-	410	491	-
Stage 2	-	-	-	-	-	-	482	489	-	393	465	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.2	181.8	24.3
HCM LOS			F	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	161	977	-	-	983	-	-	199
HCM Lane V/C Ratio	1.173	0.016	-	-	0.011	-	-	0.061
HCM Control Delay (s)	181.8	8.7	0	-	8.7	0	-	24.3
HCM Lane LOS	F	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	10.3	0	-	-	0	-	-	0.2

Notes			
~: Volume exceeds capacity	\$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon




Intersection												
Int Delay, s/veh	12											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	3	716	174	8	656	3	66	2	6	9	2	19
Future Vol, veh/h	3	716	174	8	656	3	66	2	6	9	2	19
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	90	90	90	88	88	88	57	57	57
Heavy Vehicles, %	0	1	0	0	2	0	0	50	0	0	0	5
Mvmt Flow	3	778	189	9	729	3	75	2	7	16	4	33

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	732	0	0	967	0	0	1646	1629	873	1632	1722	731
Stage 1	-	-	-	-	-	-	879	879	-	749	749	-
Stage 2	-	-	-	-	-	-	767	750	-	883	973	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	7	6.2	7.1	6.5	6.25
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	6	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	6	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4.45	3.3	3.5	4	3.345
Pot Cap-1 Maneuver	882	-	-	720	-	-	80	79	352	82	90	417
Stage 1	-	-	-	-	-	-	345	307	-	407	422	-
Stage 2	-	-	-	-	-	-	398	356	-	343	333	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	882	-	-	720	-	-	~ 70	77	352	77	87	417
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 70	77	-	77	87	-
Stage 1	-	-	-	-	-	-	342	305	-	404	413	-
Stage 2	-	-	-	-	-	-	355	349	-	331	330	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.1	238.3	37.6
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	75	882	-	-	720	-	-	162
HCM Lane V/C Ratio	1.121	0.004	-	-	0.012	-	-	0.325
HCM Control Delay (s)	238.3	9.1	0	-	10.1	0	-	37.6
HCM Lane LOS	F	A	A	-	B	A	-	E
HCM 95th %tile Q(veh)	6.2	0	-	-	0	-	-	1.3

Notes			
~: Volume exceeds capacity	\$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection						
Int Delay, s/veh	13.1					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	537	54	11	530	164	8
Future Vol, veh/h	537	54	11	530	164	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	91	91	90	90
Heavy Vehicles, %	2	7	0	4	0	0
Mvmt Flow	584	59	12	582	182	9
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	643	0	1220	614
Stage 1	-	-	-	-	614	-
Stage 2	-	-	-	-	606	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	951	-	201	496
Stage 1	-	-	-	-	544	-
Stage 2	-	-	-	-	548	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	951	-	197	496
Mov Cap-2 Maneuver	-	-	-	-	197	-
Stage 1	-	-	-	-	544	-
Stage 2	-	-	-	-	538	-
Approach	EB		WB		NB	
HCM Control Delay, s	0		0.2		97.2	
HCM LOS	F					
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)	203	-	-	951	-	
HCM Lane V/C Ratio	0.941	-	-	0.013	-	
HCM Control Delay (s)	97.2	-	-	8.8	0	
HCM Lane LOS	F	-	-	A	A	
HCM 95th %tile Q(veh)	7.8	-	-	0	-	

Intersection						
Int Delay, s/veh	5					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	1			1	2	
Traffic Vol, veh/h	737	176	10	694	67	8
Future Vol, veh/h	737	176	10	694	67	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	90	90	88	88
Heavy Vehicles, %	1	0	0	2	0	0
Mvmt Flow	801	191	11	771	76	9




Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	992
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	705
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	705
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-




Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	107.4
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	109	-	-	705	-
HCM Lane V/C Ratio	0.782	-	-	0.016	-
HCM Control Delay (s)	107.4	-	-	10.2	0
HCM Lane LOS	F	-	-	B	A
HCM 95th %tile Q(veh)	4.4	-	-	0	-

Worcester Street (Route 122) at Hilltop Street/ Site Drive C

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Intersection						
Int Delay, s/veh	0.2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	531	0	1	629	7	1
Future Vol, veh/h	531	0	1	629	7	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	88	88	90	90
Heavy Vehicles, %	3	0	0	0	0	3
Mvmt Flow	565	0	1	715	8	1
Major/Minor	Major1	Major2	Minor1			
Conflicting Flow All	0	0	565	0	1282	565
Stage 1	-	-	-	-	565	-
Stage 2	-	-	-	-	717	-
Critical Hdwy	-	-	4.1	-	6.4	6.23
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.327
Pot Cap-1 Maneuver	-	-	1017	-	184	522
Stage 1	-	-	-	-	573	-
Stage 2	-	-	-	-	487	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1017	-	184	522
Mov Cap-2 Maneuver	-	-	-	-	184	-
Stage 1	-	-	-	-	573	-
Stage 2	-	-	-	-	486	-
Approach	EB	WB		NB		
HCM Control Delay, s	0	0		23.8		
HCM LOS	C					
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)	200	-	-	1017	-	
HCM Lane V/C Ratio	0.044	-	-	0.001	-	
HCM Control Delay (s)	23.8	-	-	8.5	0	
HCM Lane LOS	C	-	-	A	A	
HCM 95th %tile Q(veh)	0.1	-	-	0	-	

Intersection						
Int Delay, s/veh	0.6					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	826	8	2	689	7	6
Future Vol, veh/h	826	8	2	689	7	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	91	91	46	48
Heavy Vehicles, %	1	0	0	2	0	0
Mvmt Flow	918	9	2	757	15	13

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	927	0	1684
Stage 1	-	-	-	-	923
Stage 2	-	-	-	-	761
Critical Hdwy	-	-	4.1	-	6.4
Critical Hdwy Stg 1	-	-	-	-	5.4
Critical Hdwy Stg 2	-	-	-	-	5.4
Follow-up Hdwy	-	-	2.2	-	3.5
Pot Cap-1 Maneuver	-	-	746	-	105
Stage 1	-	-	-	-	390
Stage 2	-	-	-	-	465
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	746	-	104
Mov Cap-2 Maneuver	-	-	-	-	104
Stage 1	-	-	-	-	390
Stage 2	-	-	-	-	463

Approach	EB	WB	NB
HCM Control Delay, s	0	0	34.4
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	150	-	-	746	-
HCM Lane V/C Ratio	0.185	-	-	0.003	-
HCM Control Delay (s)	34.4	-	-	9.8	0
HCM Lane LOS	D	-	-	A	A
HCM 95th %tile Q(veh)	0.7	-	-	0	-

Intersection						
Int Delay, s/veh	0.2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰			↱	↰	↱
Traffic Vol, veh/h	569	0	1	674	8	1
Future Vol, veh/h	569	0	1	674	8	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	88	88	90	90
Heavy Vehicles, %	3	0	0	0	0	3
Mvmt Flow	605	0	1	766	9	1




Major/Minor	Major1	Major2	Minor1			
Conflicting Flow All	0	0	605	0	1373	605
Stage 1	-	-	-	-	605	-
Stage 2	-	-	-	-	768	-
Critical Hdwy	-	-	4.1	-	6.4	6.23
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.327
Pot Cap-1 Maneuver	-	-	983	-	162	496
Stage 1	-	-	-	-	549	-
Stage 2	-	-	-	-	461	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	983	-	162	496
Mov Cap-2 Maneuver	-	-	-	-	162	-
Stage 1	-	-	-	-	549	-
Stage 2	-	-	-	-	460	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	26.8
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	175	-	-	983	-
HCM Lane V/C Ratio	0.057	-	-	0.001	-
HCM Control Delay (s)	26.8	-	-	8.7	0
HCM Lane LOS	D	-	-	A	A
HCM 95th %tile Q(veh)	0.2	-	-	0	-

Intersection

Int Delay, s/veh 0.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	887	9	2	739	8	6
Future Vol, veh/h	887	9	2	739	8	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	91	91	46	48
Heavy Vehicles, %	1	0	0	2	0	0
Mvmt Flow	986	10	2	812	17	13

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	996
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	703
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	703
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	42.6
HCM LOS			E

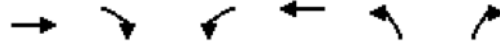
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	125	-	-	703	-
HCM Lane V/C Ratio	0.239	-	-	0.003	-
HCM Control Delay (s)	42.6	-	-	10.1	0
HCM Lane LOS	E	-	-	B	A
HCM 95th %tile Q(veh)	0.9	-	-	0	-

Intersection												
Int Delay, s/veh	0.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	13	588	0	1	683	10	8	0	1	2	0	1
Future Vol, veh/h	13	588	0	1	683	10	8	0	1	2	0	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	88	88	88	90	90	90	92	92	92
Heavy Vehicles, %	2	3	0	0	0	2	0	2	3	2	2	2
Mvmt Flow	14	626	0	1	776	11	9	0	1	2	0	1
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	787	0	0	626	0	0	1438	1443	626	1439	1438	782
Stage 1	-	-	-	-	-	-	654	654	-	784	784	-
Stage 2	-	-	-	-	-	-	784	789	-	655	654	-
Critical Hdwy	4.12	-	-	4.1	-	-	7.1	6.52	6.23	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.2	-	-	3.5	4.018	3.327	3.518	4.018	3.318
Pot Cap-1 Maneuver	832	-	-	965	-	-	112	132	482	111	133	394
Stage 1	-	-	-	-	-	-	459	463	-	386	404	-
Stage 2	-	-	-	-	-	-	389	402	-	455	463	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	832	-	-	965	-	-	109	128	482	108	129	394
Mov Cap-2 Maneuver	-	-	-	-	-	-	109	128	-	108	129	-
Stage 1	-	-	-	-	-	-	447	451	-	376	403	-
Stage 2	-	-	-	-	-	-	387	401	-	442	451	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.2			0			38			30.9		
HCM LOS							E			D		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	119	832	-	-	965	-	-	142				
HCM Lane V/C Ratio	0.084	0.017	-	-	0.001	-	-	0.023				
HCM Control Delay (s)	38	9.4	0	-	8.7	0	-	30.9				
HCM Lane LOS	E	A	A	-	A	A	-	D				
HCM 95th %tile Q(veh)	0.3	0.1	-	-	0	-	-	0.1				

Intersection												
Int Delay, s/veh	1.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	3	896	9	2	755	4	8	0	6	11	0	18
Future Vol, veh/h	3	896	9	2	755	4	8	0	6	11	0	18
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	91	91	91	48	48	48	92	92	92
Heavy Vehicles, %	2	1	0	0	2	2	0	2	0	2	2	2
Mvmt Flow	3	996	10	2	830	4	17	0	13	12	0	20
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	834	0	0	1006	0	0	1853	1845	1001	1850	1848	832
Stage 1	-	-	-	-	-	-	1007	1007	-	836	836	-
Stage 2	-	-	-	-	-	-	846	838	-	1014	1012	-
Critical Hdwy	4.12	-	-	4.1	-	-	7.1	6.52	6.2	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.2	-	-	3.5	4.018	3.3	3.518	4.018	3.318
Pot Cap-1 Maneuver	799	-	-	697	-	-	57	75	297	57	75	369
Stage 1	-	-	-	-	-	-	293	319	-	362	382	-
Stage 2	-	-	-	-	-	-	360	382	-	288	317	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	799	-	-	697	-	-	53	74	297	54	74	369
Mov Cap-2 Maneuver	-	-	-	-	-	-	53	74	-	54	74	-
Stage 1	-	-	-	-	-	-	290	316	-	359	380	-
Stage 2	-	-	-	-	-	-	339	380	-	273	314	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0			71.4			47.7		
HCM LOS							F			E		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	82	799	-	-	697	-	-	115				
HCM Lane V/C Ratio	0.356	0.004	-	-	0.003	-	-	0.274				
HCM Control Delay (s)	71.4	9.5	0	-	10.2	0	-	47.7				
HCM Lane LOS	F	A	A	-	B	A	-	E				
HCM 95th %tile Q(veh)	1.4	0	-	-	0	-	-	1				

Grafton Road (Route 122) at Massachusetts Turnpike (I-90) – Westbound Ramp (Exit 11 )

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	268	436	309	346	339	278
Future Volume (vph)	268	436	309	346	339	278
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12	16	16
Storage Length (ft)		200	150		0	200
Storage Lanes		1	1		1	1
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1881	1382	1703	1881	1877	1743
Flt Permitted			0.344		0.950	
Satd. Flow (perm)	1881	1382	617	1881	1877	1743
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		232				323
Link Speed (mph)	35			35	30	
Link Distance (ft)	560			739	870	
Travel Time (s)	10.9			14.4	19.8	
Peak Hour Factor	0.94	0.94	0.92	0.92	0.86	0.86
Heavy Vehicles (%)	1%	13%	6%	1%	9%	5%
Adj. Flow (vph)	285	464	336	376	394	323
Shared Lane Traffic (%)						
Lane Group Flow (vph)	285	464	336	376	394	323
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	16	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.04	1.00	1.00	0.85	0.85
Turning Speed (mph)		9	15		15	9
Turn Type	NA	custom	pm+pt	NA	Prot	Free
Protected Phases	2	4	1	6	8	
Permitted Phases		2	6			Free
Detector Phase	2	4	1	6	8	
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	23.5	24.0	10.5	23.5	24.0	
Total Split (s)	35.0	30.0	15.0	50.0	30.0	
Total Split (%)	43.8%	37.5%	18.8%	62.5%	37.5%	
Maximum Green (s)	30.0	24.0	10.0	45.0	24.0	
Yellow Time (s)	3.0	4.0	3.0	3.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	6.0	5.0	5.0	6.0	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Recall Mode	None	None	None	None	Min	
Walk Time (s)					7.0	
Flash Dont Walk (s)					11.0	
Pedestrian Calls (#/hr)					2	
Act Effect Green (s)	14.3	36.4	29.3	29.3	16.9	57.5
Actuated g/C Ratio	0.25	0.63	0.51	0.51	0.29	1.00
v/c Ratio	0.61	0.48	0.67	0.39	0.71	0.19
Control Delay	26.0	4.1	18.1	10.8	26.8	0.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.0	4.1	18.1	10.8	26.8	0.2
LOS	C	A	B	B	C	A
Approach Delay	12.5			14.3	14.8	
Approach LOS	B			B	B	
Queue Length 50th (ft)	86	29	64	72	119	0
Queue Length 95th (ft)	173	63	#159	154	215	0
Internal Link Dist (ft)	480			659	790	
Turn Bay Length (ft)		200	150			200
Base Capacity (vph)	1008	1114	508	1502	805	1743
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.28	0.42	0.66	0.25	0.49	0.19

## Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 57.5

Natural Cycle: 60

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.71

Intersection Signal Delay: 13.8

Intersection LOS: B

Intersection Capacity Utilization 63.3%

ICU Level of Service B

Analysis Period (min) 15

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 3: I-90 WB Ramp Exit 11 &amp; Grafton Road ( Route 122)

15 s	35 s	30 s
50 s		30 s

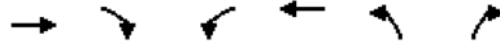
# Lanes, Volumes, Timings

2021 Existing Condition Weekday Morning

## 3: I-90 WB Ramp Exit 11 & Grafton Road ( Route 122)

04/26/2021

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	504	322	303	405	518	329
Future Volume (vph)	504	322	303	405	518	329
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12	16	16
Storage Length (ft)		200	150		0	200
Storage Lanes		1	1		1	1
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1900	1446	1770	1881	1948	1794
Flt Permitted			0.127		0.950	
Satd. Flow (perm)	1900	1446	237	1881	1948	1794
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		103				257
Link Speed (mph)	35			35	30	
Link Distance (ft)	560			739	870	
Travel Time (s)	10.9			14.4	19.8	
Peak Hour Factor	0.88	0.83	0.93	0.93	0.83	0.83
Heavy Vehicles (%)	0%	8%	2%	1%	5%	2%
Adj. Flow (vph)	573	388	326	435	624	396
Shared Lane Traffic (%)						
Lane Group Flow (vph)	573	388	326	435	624	396
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	16	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.04	1.00	1.00	0.85	0.85
Turning Speed (mph)		9	15		15	9
Turn Type	NA	custom	pm+pt	NA	Prot	Free
Protected Phases	2	4	1	6	8	
Permitted Phases		2	6			Free
Detector Phase	2	4	1	6	8	
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	23.5	24.0	10.5	23.5	24.0	
Total Split (s)	35.0	30.0	15.0	50.0	30.0	
Total Split (%)	43.8%	37.5%	18.8%	62.5%	37.5%	
Maximum Green (s)	30.0	24.0	10.0	45.0	24.0	
Yellow Time (s)	3.0	4.0	3.0	3.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	6.0	5.0	5.0	6.0	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Recall Mode	None	None	None	None	Min	
Walk Time (s)					7.0	
Flash Dont Walk (s)					11.0	
Pedestrian Calls (#/hr)					2	
Act Effect Green (s)	26.5	55.6	41.6	41.6	24.1	76.7
Actuated g/C Ratio	0.35	0.72	0.54	0.54	0.31	1.00
v/c Ratio	0.87	0.36	0.99	0.43	1.02	0.22
Control Delay	39.2	3.7	69.0	11.8	71.5	0.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.2	3.7	69.0	11.8	71.5	0.3
LOS	D	A	E	B	E	A
Approach Delay	24.8			36.3	43.9	
Approach LOS	C			D	D	
Queue Length 50th (ft)	251	37	~108	114	~350	0
Queue Length 95th (ft)	#402	58	#275	177	#480	0
Internal Link Dist (ft)	480			659	790	
Turn Bay Length (ft)		200	150			200
Base Capacity (vph)	745	1076	328	1107	611	1794
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.77	0.36	0.99	0.39	1.02	0.22

## Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 76.7

Natural Cycle: 90

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.02

Intersection Signal Delay: 35.1

Intersection LOS: D

Intersection Capacity Utilization 85.3%

ICU Level of Service E

Analysis Period (min) 15






~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 3: I-90 WB Ramp Exit 11 &amp; Grafton Road ( Route 122)

 Ø1	 Ø2	 Ø4
15 s	35 s	30 s
 Ø6		 Ø8
50 s		30 s

Lanes, Volumes, Timings  
3: I-90 WB Ramp Exit 11 & Grafton Road ( Route 122)

2028 No Build Weekday Morning

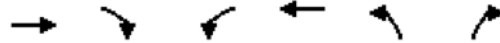
04/26/2021

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	287	468	331	371	364	298
Future Volume (vph)	287	468	331	371	364	298
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12	16	16
Storage Length (ft)		200	150		0	200
Storage Lanes		1	1		1	1
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1881	1382	1703	1881	1877	1743
Flt Permitted			0.320		0.950	
Satd. Flow (perm)	1881	1382	574	1881	1877	1743
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		193				332
Link Speed (mph)	35			35	30	
Link Distance (ft)	560			739	870	
Travel Time (s)	10.9			14.4	19.8	
Peak Hour Factor	0.94	0.94	0.92	0.92	0.86	0.86
Heavy Vehicles (%)	1%	13%	6%	1%	9%	5%
Adj. Flow (vph)	305	498	360	403	423	347
Shared Lane Traffic (%)						
Lane Group Flow (vph)	305	498	360	403	423	347
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	16	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.04	1.00	1.00	0.85	0.85
Turning Speed (mph)		9	15		15	9
Turn Type	NA	custom	pm+pt	NA	Prot	Free
Protected Phases	2	4	1	6	8	
Permitted Phases		2	6			Free
Detector Phase	2	4	1	6	8	
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	23.5	24.0	10.5	23.5	24.0	
Total Split (s)	35.0	30.0	15.0	50.0	30.0	
Total Split (%)	43.8%	37.5%	18.8%	62.5%	37.5%	
Maximum Green (s)	30.0	24.0	10.0	45.0	24.0	
Yellow Time (s)	3.0	4.0	3.0	3.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	6.0	5.0	5.0	6.0	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	

Lanes, Volumes, Timings  
3: I-90 WB Ramp Exit 11 & Grafton Road ( Route 122)

2028 No Build Weekday Morning

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Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Recall Mode	None	None	None	None	Min	
Walk Time (s)					7.0	
Flash Dont Walk (s)					11.0	
Pedestrian Calls (#/hr)					2	
Act Effect Green (s)	15.2	38.6	30.3	30.3	18.3	59.8
Actuated g/C Ratio	0.25	0.65	0.51	0.51	0.31	1.00
v/c Ratio	0.64	0.52	0.75	0.42	0.74	0.20
Control Delay	27.2	5.0	23.1	11.6	28.0	0.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.2	5.0	23.1	11.6	28.0	0.3
LOS	C	A	C	B	C	A
Approach Delay	13.5			17.0	15.5	
Approach LOS	B			B	B	
Queue Length 50th (ft)	98	41	75	85	134	0
Queue Length 95th (ft)	185	85	#194	165	239	0
Internal Link Dist (ft)	480			659	790	
Turn Bay Length (ft)		200	150			200
Base Capacity (vph)	967	1086	484	1451	772	1743
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.46	0.74	0.28	0.55	0.20

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 59.8

Natural Cycle: 60

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.75

Intersection Signal Delay: 15.3

Intersection LOS: B

Intersection Capacity Utilization 66.9%

ICU Level of Service C

Analysis Period (min) 15

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 3: I-90 WB Ramp Exit 11 & Grafton Road ( Route 122)

15 s	35 s	30 s
50 s		30 s

Lanes, Volumes, Timings  
3: I-90 WB Ramp Exit 11 & Grafton Road ( Route 122)

2028 No Build Weekday Morning

04/26/2021

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	540	347	325	434	556	353
Future Volume (vph)	540	347	325	434	556	353
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12	16	16
Storage Length (ft)		200	150		0	200
Storage Lanes		1	1		1	1
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1900	1446	1770	1881	1948	1794
Flt Permitted			0.122		0.950	
Satd. Flow (perm)	1900	1446	227	1881	1948	1794
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		84				257
Link Speed (mph)	35			35	30	
Link Distance (ft)	560			739	870	
Travel Time (s)	10.9			14.4	19.8	
Peak Hour Factor	0.88	0.83	0.93	0.93	0.83	0.83
Heavy Vehicles (%)	0%	8%	2%	1%	5%	2%
Adj. Flow (vph)	614	418	349	467	670	425
Shared Lane Traffic (%)						
Lane Group Flow (vph)	614	418	349	467	670	425
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	16	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.04	1.00	1.00	0.85	0.85
Turning Speed (mph)		9	15		15	9
Turn Type	NA	custom	pm+pt	NA	Prot	Free
Protected Phases	2	4	1	6	8	
Permitted Phases		2	6			Free
Detector Phase	2	4	1	6	8	
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	23.5	24.0	10.5	23.5	24.0	
Total Split (s)	35.0	30.0	15.0	50.0	30.0	
Total Split (%)	43.8%	37.5%	18.8%	62.5%	37.5%	
Maximum Green (s)	30.0	24.0	10.0	45.0	24.0	
Yellow Time (s)	3.0	4.0	3.0	3.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	6.0	5.0	5.0	6.0	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	

Lanes, Volumes, Timings  
3: I-90 WB Ramp Exit 11 & Grafton Road ( Route 122)

2028 No Build Weekday Morning

04/26/2021

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Recall Mode	None	None	None	None	Min	
Walk Time (s)					7.0	
Flash Dont Walk (s)					11.0	
Pedestrian Calls (#/hr)					2	
Act Effect Green (s)	27.9	57.0	42.9	42.9	24.1	78.0
Actuated g/C Ratio	0.36	0.73	0.55	0.55	0.31	1.00
v/c Ratio	0.90	0.39	1.08	0.45	1.12	0.24
Control Delay	42.7	4.2	95.5	12.1	101.9	0.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	42.7	4.2	95.5	12.1	101.9	0.3
LOS	D	A	F	B	F	A
Approach Delay	27.1			47.8	62.5	
Approach LOS	C			D	E	
Queue Length 50th (ft)	277	45	~145	125	~399	0
Queue Length 95th (ft)	#449	69	#309	193	#529	0
Internal Link Dist (ft)	480			659	790	
Turn Bay Length (ft)		200	150			200
Base Capacity (vph)	732	1078	323	1087	600	1794
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.84	0.39	1.08	0.43	1.12	0.24

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 78

Natural Cycle: 90

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.12

Intersection Signal Delay: 46.0

Intersection LOS: D

Intersection Capacity Utilization 90.6%

ICU Level of Service E

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 3: I-90 WB Ramp Exit 11 & Grafton Road ( Route 122)

↙ Ø1	→ Ø2	↘ Ø4
15 s	35 s	30 s
↖ Ø6		↗ Ø8
50 s		30 s

Lanes, Volumes, Timings  
3: I-90 WB Ramp Exit 11 & Grafton Road ( Route 122)

2028 Build Weekday Morning

04/26/2021

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	297	468	338	374	364	320
Future Volume (vph)	297	468	338	374	364	320
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12	16	16
Storage Length (ft)		200	150		0	200
Storage Lanes		1	1		1	1
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1881	1382	1703	1881	1877	1743
Flt Permitted			0.309		0.950	
Satd. Flow (perm)	1881	1382	554	1881	1877	1743
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		180				356
Link Speed (mph)	35			35	30	
Link Distance (ft)	560			739	870	
Travel Time (s)	10.9			14.4	19.8	
Peak Hour Factor	0.94	0.94	0.92	0.92	0.86	0.86
Heavy Vehicles (%)	1%	13%	6%	1%	9%	5%
Adj. Flow (vph)	316	498	367	407	423	372
Shared Lane Traffic (%)						
Lane Group Flow (vph)	316	498	367	407	423	372
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	16	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.04	1.00	1.00	0.85	0.85
Turning Speed (mph)		9	15		15	9
Turn Type	NA	custom	pm+pt	NA	Prot	Free
Protected Phases	2	4	1	6	8	
Permitted Phases		2	6			Free
Detector Phase	2	4	1	6	8	
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	23.5	24.0	10.5	23.5	24.0	
Total Split (s)	35.0	30.0	15.0	50.0	30.0	
Total Split (%)	43.8%	37.5%	18.8%	62.5%	37.5%	
Maximum Green (s)	30.0	24.0	10.0	45.0	24.0	
Yellow Time (s)	3.0	4.0	3.0	3.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	6.0	5.0	5.0	6.0	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	

Lanes, Volumes, Timings  
3: I-90 WB Ramp Exit 11 & Grafton Road ( Route 122)

2028 Build Weekday Morning

04/26/2021

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Recall Mode	None	None	None	None	Min	
Walk Time (s)					7.0	
Flash Dont Walk (s)					11.0	
Pedestrian Calls (#/hr)					2	
Act Effect Green (s)	15.6	39.1	30.7	30.7	18.4	60.4
Actuated g/C Ratio	0.26	0.65	0.51	0.51	0.30	1.00
v/c Ratio	0.65	0.52	0.78	0.43	0.74	0.21
Control Delay	27.5	5.2	25.0	11.6	28.4	0.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.5	5.2	25.0	11.6	28.4	0.3
LOS	C	A	C	B	C	A
Approach Delay	13.8			17.9	15.3	
Approach LOS	B			B	B	
Queue Length 50th (ft)	103	43	78	86	136	0
Queue Length 95th (ft)	191	88	#206	167	243	0
Internal Link Dist (ft)	480			659	790	
Turn Bay Length (ft)		200	150			200
Base Capacity (vph)	958	1083	477	1438	765	1743
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.46	0.77	0.28	0.55	0.21

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 60.4

Natural Cycle: 60

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.78

Intersection Signal Delay: 15.6

Intersection LOS: B

Intersection Capacity Utilization 67.9%

ICU Level of Service C

Analysis Period (min) 15

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 3: I-90 WB Ramp Exit 11 & Grafton Road ( Route 122)

↙ Ø1	→ Ø2	↘ Ø4
15 s	35 s	30 s
↖ Ø6		↗ Ø8
50 s		30 s

Lanes, Volumes, Timings  
3: I-90 WB Ramp Exit 11 & Grafton Road ( Route 122)

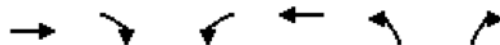
2028 Build Weekday Evening

04/26/2021

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	544	347	349	444	556	361
Future Volume (vph)	544	347	349	444	556	361
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12	16	16
Storage Length (ft)		200	150		0	200
Storage Lanes		1	1		1	1
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1900	1446	1770	1881	1948	1794
Flt Permitted			0.121		0.950	
Satd. Flow (perm)	1900	1446	225	1881	1948	1794
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		68				263
Link Speed (mph)	35			35	30	
Link Distance (ft)	560			739	870	
Travel Time (s)	10.9			14.4	19.8	
Peak Hour Factor	0.88	0.83	0.93	0.93	0.83	0.83
Heavy Vehicles (%)	0%	8%	2%	1%	5%	2%
Adj. Flow (vph)	618	418	375	477	670	435
Shared Lane Traffic (%)						
Lane Group Flow (vph)	618	418	375	477	670	435
Number of Detectors	2	1	1	2	1	1
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (ft)	100	20	20	100	20	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)	94			94		
Detector 2 Size(ft)	6			6		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	custom	pm+pt	NA	Prot	Free
Protected Phases	2	4	1	6	8	
Permitted Phases		2	6			Free
Detector Phase	2	4	1	6	8	
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	23.5	24.0	10.5	23.5	24.0	
Total Split (s)	35.0	30.0	15.0	50.0	30.0	
Total Split (%)	43.8%	37.5%	18.8%	62.5%	37.5%	

Lanes, Volumes, Timings  
3: I-90 WB Ramp Exit 11 & Grafton Road ( Route 122)

2028 Build Weekday Evening  
04/26/2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Maximum Green (s)	30.0	24.0	10.0	45.0	24.0	
Yellow Time (s)	3.0	4.0	3.0	3.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	6.0	5.0	5.0	6.0	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	None	Min	
Walk Time (s)					7.0	
Flash Dont Walk (s)					11.0	
Pedestrian Calls (#/hr)					2	
Act Effect Green (s)	28.0	57.1	43.1	43.1	24.0	78.1
Actuated g/C Ratio	0.36	0.73	0.55	0.55	0.31	1.00
v/c Ratio	0.91	0.39	1.17	0.46	1.12	0.24
Control Delay	43.0	4.4	125.3	12.2	102.7	0.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.0	4.4	125.3	12.2	102.7	0.3
LOS	D	A	F	B	F	A
Approach Delay	27.4			62.0	62.4	
Approach LOS	C			E	E	
Queue Length 50th (ft)	280	48	~174	129	~399	0
Queue Length 95th (ft)	#453	73	#342	199	#529	0
Internal Link Dist (ft)	480			659	790	
Turn Bay Length (ft)		200	150			200
Base Capacity (vph)	730	1075	321	1085	599	1794
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.85	0.39	1.17	0.44	1.12	0.24

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 78.1

Natural Cycle: 100

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.17

Intersection Signal Delay: 50.2

Intersection LOS: D

Intersection Capacity Utilization 92.1%

ICU Level of Service F

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 3: I-90 WB Ramp Exit 11 & Grafton Road ( Route 122)

Ø1 15 s	Ø2 35 s	Ø4 30 s
Ø6 50 s		Ø8 30 s